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INTERESTING EXPERIMENTS WITH CANAL BOATS.

We regard the experiments described below as extremely important. If the result is correctly stated, and if no counteracting disadvantage has escaped notice, we think these experiments may be said to have added a million sterling to the value of canal property in Great Britain, since they must at no distant period, add fifty or an hundred thousand pounds to the annual dividends. Nothing can be more paradoxical or startling in appearance than this result; and yet our knowledge of the many unexpected truths in mechanical science which experiment has brought to light, will not permit us to reject it as incredible. It is this: *that the surge generated in a canal by the motion of a boat, and which is so destructive to the banks, in moderately rapid motions,* (such as 4 or 5 miles an hour,) *ceases altogether when a high velocity is employed!* It is true the vessels were of a particular construction, but this is immaterial. A boat 60 feet long and 5 feet wide, is capable of being extremely serviceable, both for the conveyance of goods and passengers; and if such a boat can be safely and conveniently dragged at the rate of 9 or 10 miles an hour upon our canals, passengers by this species of conveyance will be upon a level as to speed with those who travel per mail. The great recommendation of canal carriage, at present, are its cheapness, and the liberty of locomotion which passengers enjoy. Its leading disadvantage is its slowness; and this is felt now more and more, when our stage-coaches are touching a speed of ten miles an hour, which will soon be doubled on our railways. We have not technical skill enough to know what a gig-boat is, but we infer from the other particulars stated that it must be flat-bottomed in the cross section, pretty well curved upwards at stem and stern, and very light. With this form, the quicker it is moved the less water it will draw. At a very high velocity, it will merely skim the surface as it were; the displacement of the fluid will reach only a few inches down; and this circumstance, with the quick motion of the boat, causing a readjustment of the equilibrium of the water equally rapid, the necessary time will be wanting for the motion to propagate itself beyond the narrow zone of the water which immediately encompasses the boat. Such is our hypothesis, supposing the fact to be as stated. We have a strong impression, however, that the result depends chiefly on the form of the boat, and that a much greater breadth than 5 feet will be no material disadvantage, except where the canal is extremely narrow.

Some months ago, by the suggestion of Mr. Wm. Houston of Johnstone, the Committee of Management of the Ardrossan and Paisley Canal, were induced to make certain experiments for ascertaining the rate of velocity at which a light gig-boat might be propelled along that canal. The experiments were made with a gig-rowing boat of about 30 feet in length, constructed by Mr. Hunter, Boat-builder, Brown st., Glasgow; and this boat, with 10 men on board, was drawn two miles along the Ardrossan or Paisley Canal, in the space of less than 10 minutes, without raising any surge or commotion on the water—the force employed being one horse, rode by a canal-driver. No account of this trial has ever been given to the publick, but it was so satisfactory as to induce the Committee of the Ardrossan Canal to contract with Mr. Wood of Port Glasgow, for a gig-shaped passage boat, 60 feet in length, and 5 feet in breadth, fitted to carry from 36 to 40 passengers. In the month of April last, a number of experiments were made in the Forth and Clyde Canal, with two gig-boats fixed together, constructed by Mr. Hunter, and thus forming what is called a twin-boat. The object of these trials was to ascertain the rate of speed at which vessels might be propelled along that canal, and the effect of

a light double or twin-boat, in giving that degree of steadiness which it was apprehended would be so much wanting in a light single boat. A statement of these experiments on the Forth and Clyde Canal has already appeared in the newspapers, and the only fact therein mentioned, which it seems necessary to repeat here, is the remarkable circumstance, that the quicker the boats were propelled through the water, the less appearance there was of a surge or wave on the sides of the canal. The result of the experiment was so satisfactory, that a twin-boat of a gig-shape, 60 feet in length, and 9 feet broad, is at present building by Mr. Hunter, and will be launched in the Forth and Clyde Canal in the course of the present month.

The single gig-shaped passage boat, contracted for by the Ardrossan Canal Committee was launched at Port Glasgow on Wednesday se'enight, the second of June, and she was towed up to the Broomielaw, and thence carried to Port Eglinton, the day following: and on Friday, the 4th of June, a trial, of which the following is an account, took place. The boat is 60 feet long, 4 feet 6 inches breadth of beam, and drew on an average, including a deep keel, 10 inches when light:—

From the great hurry in which this trial was made, it was done under many disadvantages. The boat started from Port Eglinton for Paisley, a few minutes after one o'clock, with 20 passengers on board, and the distance from Port Eglinton to Paisley being 7 miles, was accomplished in 1 hour and 7 minutes. The rider was ordered to start and proceed the first mile or so at a very moderate pace, but even at this moderate pace the wave raised in front of the boat was very considerable. A high wave was seen on the canal preceding the boat, about 80 or 90 feet in front, and in some cases farther, and causing an overflow at the bridges, and in the narrow parts of the canal. The surge, or cutting wave, behind the boat was, however, comparatively slight, and except at the curves, would not have caused much injury to the canal-banks. The horse was very much exhausted when he got to Paisley, though by no means so exhausted as he was about the middle of the journey, having sensibly recovered after the first four or five miles.

Two post-horses were hired there; and lighter towing lines being attached to the boat, it started again, on its return, to Glasgow, with 24 persons on board, 4 of whom were boys, and arrived at Glasgow, a distance of 7 miles, in 45 minutes. The greatest speed attained during the journey was 2 miles in 11 minutes. During this voyage the surge behind was entirely got quit of, even at the curves, where it was reduced to nothing; and there was no front wave, except at the bridges. It appeared only at the bridges, and just as the boat was about to enter under the bridge, and gradually disappeared as the stern of the boat cleared the bridge. *The quicker the boat went, the more entire was the disappearance of all wave and surge*, except where the water escaped in the centre of the canal, and met in two very noisy and rapid currents from each side of the boat at the rudder. This noise and rush of water was so great behind as to induce persons on board to look round, expecting to see a great wave or surge on the bank of the canal, but on the banks there was hardly a ripple. The two rapid, noisy currents seemed to be completely spent and exhausted by the shock of their concourse behind the boat. Here, therefore, there was no room to doubt of the correctness of the reports of the Forth and Clyde Canal experiments. It was not merely to be said that the greater the speed the less the surge or wave, but it was demonstrated that *at a high rate of speed, surge and wave were done away with altogether*. Unluckily, there was no dynamometer attached to the rope, so as to ascertain whether, contrary to all theory, the strain or pull was not equally diminished with the wave, and the tugging labour of the two horses lessened instead of increased, by the accelerated rate at which they drew the boat. There can be no doubt, however, that with one trained horse, properly attached, the distance could be done in a period under 40 minutes. Contrary to expectation, Mr. Wood's boat was quite steady in the water, and by no means crank.

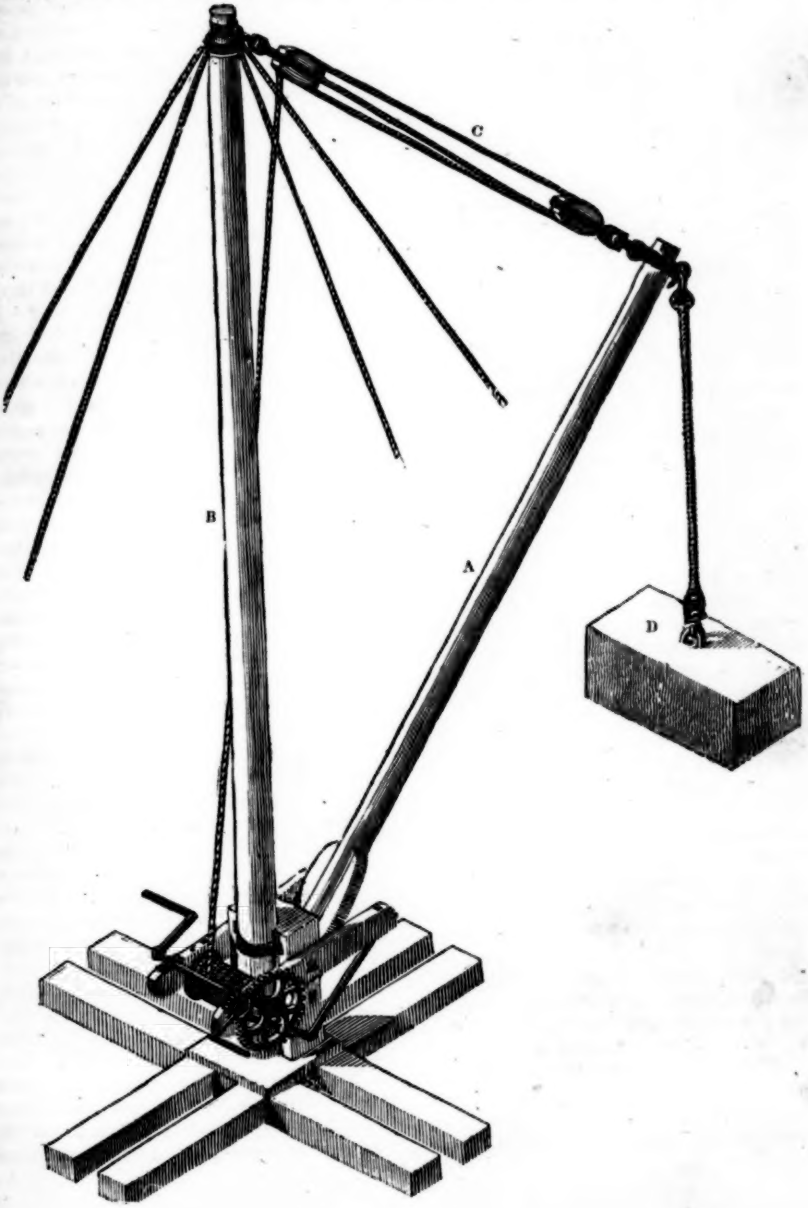
It may be proper to mention that the Ardrossan Canal is throughout very narrow; at the bridges and many other places it is only 9 feet broad. It has a great number of turns, and many of them very sudden.

COMMUNICATION.] [FOR THE MAGAZINE.

IMPROVED HOISTING MACHINE, OR "BOOM DERICK."

The annexed drawing was taken from one of these machines, which has been in constant operation a long time, for the purpose of laying stone, and is found to

possess superior advantages in some respects over the other kinds of dericks. The simplicity of its parts, and moreover the ease with which it may be worked, renders it very useful in building cellar walls, and all constructions composed of large stones. The boom A turns in a centre, and is raised or lowered in a vertical plane, by means of the ropes C. The boom with the wheel and pinion and supports can be turned in a horizontal direction about the mast B, so that the stone D can be placed in any required spot without moving the whole of the machine as in common dericks. An elaborate description of the other parts and their mode of action is unnecessary, as they may be understood at once from the drawing. * *



CHYMISTRY.—OF THE METALS.

Mercury.—Mercury is always fluid when in a pure state, and is one of the most brilliant and shining of all known metals. When its surface is sufficiently clear, it forms a very fine mirror. Its colour is as beautiful as that of silver, with which it has always been compared. After platina and gold, it is considered as the heaviest of all known bodies. Its specifick gravity is 13·568, taking water at 1·000.—Authors were formerly very particular in observing, that all the most ponderous substances swam upon its surface, whilst gold alone sunk in it; at the present day we have to add to this, platina and tungsten.

Boerhaave asserted, in his Elements of Chymistry, that mercury could not be rendered solid by any degree of cold, though he admits a condensation of $\frac{1}{269}$ of its primitive volume; a circumstance which cannot take place in its real congelation. This assertion of Boerhaave, and other philosophers who have followed him, was proved to be false in the year 1759; in which year the academicians of Petersburg, availing themselves of an intense degree of natural cold, augmented it still further by a mixture of snow and fuming nitrous acid; the mercurial thermometer, which they used, descended to 213 degrees of De Lisle's scale, which corresponds with 46 below 0 of that of Fahrenheit. As the mercury did not descend any lower, but seemed stationary, the academicians broke the glass bulb of their instrument, in which they found congealed mercury, that formed a solid substance susceptible of being extended by the hammer. They thus discovered that mercury might become solid, and that in this state it possessed a certain degree of ductility. They remarked, that at every stroke of the hammer, the pressure, developing the calorick in the interior of the metal, fused it, and that it ran into globules.

This first experiment was, in some measure, nothing more than a hint to philosophers concerning a property unknown, and till then even denied, in mercury; it has since been often repeated, and of late it has become as easy and simple an experiment as most of those that are made in chymistry. In the year 1772, Pallas caused mercury to congeal, at Krasnejark, by a natural cold of—$55\frac{1}{2}$ deg. of Fahrenheit's scale. It was observed that it then resembled soft tin; that it could be flattened; that it broke easily; and that its fragments, when brought into contact, were glued or soldered together, as happens in all other softened metals. However, it is evident that he did not obtain its real conversion into a solid, or complete concretion, as the mercury was still soft, and only in a state of semi-congelation. In the year 1775, Mr. Hutchins observed the same congelation at Albany Fort, and Mr. Bicker at Rotterdam, in 1776, at 56 deg. below 0. In the year 1783, the congelation of mercury was effected in England with a less degree of cold; and Mr. Cavendish has proved $31\frac{1}{2}$ below 0 of Reaumur's or 40 below Fahrenheit's thermometer, to be the real degree at which it takes place.

As a metal always fused, always liquid at the temperature of our climate, mercury constantly affects the form of perfect globules when it is divided. When inclosed in a glass phial or tube, its surface is convex, which depends upon the small attraction which it has for the glass; in fact, if we pour it into a vessel or tube of some metal with which it is able to combine, instead of remaining convex, its surface becomes concave. As this round, curved, and convex surface may give rise to some errors in barometrical observations, especially in those which are made with tubes of a fine bore, in which the elevation of the mercury ought to be an exact measure of the height of the places which we wish to determine, attempts have been made to obviate this source of error, by rendering the mercurial surface flat. Cassebois succeeded by boiling the mercury for a long time in the barometrical tubes; by which means a surface almost perfectly horizontal was obtained, especially in tubes of a wide bore.

The expansion of mercury by the action of fire has not yet been very accurately determined; it is known to be a very good conductor of calorick, on which account it appears very cold to the hand when immersed in it; and it is also owing to this conducting property that a red hot iron, when plunged into mercury, instantaneously loses its redness, which it would have retained for some time in the air, and even in water. Its expansion by heat proceeds in a very uniform manner: and it is on this account that it is employed in the construction of thermometers. When it is penetrated with a quantity of calorick, which has not yet been well ascertained, but which is estimated at 656 degrees of Fahrenheit's thermometer, the mercury swells,

is reduced to the state of vapour, and volatilized. When this experiment is performed in the air, the mercury presently condenses into a white smoke, which is capable of producing very injurious effects upon animals. If it be performed in close vessels, in such a manner that the metal may speedily become fixed and liquefied, this becomes a means of distillation, in which the habitudes of the volatile metal are the same as those of every other distilled liquid. In this operation, which is often employed for the purpose of purifying the mercury, it is customary to adapt to the neck of the retort of iron or stone-ware which is used a tube of linen, the extremity of which is immersed in the water with which the receiver is filled. By means of this apparatus, the mercury is speedily condensed into the liquid form, and collected entire under the water, from which it is afterwards separated by rubbing it with paper manufactured without size, drying it in a gentle heat, passing it through a skin, agitating it with very dry bread-crumbs, bran, and other desiccating means of a like nature. It is on account of this easy process of distillation that chymists have considered mercury as the most volatile of all metals.

Mercury is a very good conductor of electricity and galvanism. Its electrical property is probably the cause of the phosphorescence, and the considerably bright light which it emits, when it is agitated in a vacuum. It has been discovered that this phosphorescence is an electrical phenomenon, which takes place only in consequence of the friction of the mercury against the sides of the tube, and that the mercury does not thereby suffer any sensible alteration.

Mercury is not altered by being kept under water. When exposed to the air, its surface is gradually tarnished, and covered with a black powder, owing to its combining with the oxygen of the atmosphere. But this change goes on very slowly, unless the mercury be either heated or agitated; by shaking it, for instance, in a large bottle full of air. By either of these processes, the metal is converted into an oxide: by the last, into a black oxide; and by the first, into a red coloured oxide. This metal does not seem to be capable of combustion; at least, no method which has hitherto been tried to burn it has succeeded. It is the only metal which may not, by peculiar management, be made to *burn*.

Native mercury, which has been termed virgin mercury, is found in the form of liquid globules, which are very easily recognised by their brilliancy and liquidity. It is commonly found in tender and friable earths and stones, and frequently interposed between the fissures and the cavities of its own orbs, especially of its sulphuret. It is seldom perfectly pure, and frequently contains some other metal with which it is alloyed; but when it is sufficiently liquid, it is considered as pure, or really native. At Ydria, and in Spain, and America, it is collected in the cavities and clefts of the rocks, into which it filtrates from all sides. It is found liquid in Argil at Almaden, and in the beds of chalk in Sicily. It is also found in the ores of silver and lead, and even mixed with the arsenious acid, or white arsenick.

Mercury does not combine with the simple incombustibles; but it combines with the greater number of metals. These combinations are known in chymistry by the name of *amalgams*.

The amalgam of gold is formed very readily, because there is a very strong affinity between the two metals. If a bit of gold be dipped into mercury, its surface, by combining with mercury, becomes as white as silver. The easiest way of forming this amalgam is to throw small pieces of red hot gold into mercury, heated till it begins to smoke. The proportions of the ingredients are not determinable, because they combine in any proportion. This amalgam is of a silvery whiteness. By squeezing it through leather, the excess of mercury may be separated, and a soft white amalgam obtained, which gradually becomes solid, and consists of about one part of mercury to two of gold. It melts at a moderate temperature; and in a heat below redness the mercury evaporates, and leaves the gold in a state of purity. It is much used in gilding. The amalgam is spread upon the metal which is to be gilt; and then, by the application of a gentle and equal heat the mercury is driven off, and the gold left adhering to the metallick surface; this surface is then rubbed with a brass wire brush under water, and afterwards burnished.

Dr. Lewis attempted to form an amalgam of platinum, but succeeded only imperfectly, as was the case also with Scheffer. Morveau succeeded by means of heat. He fixed a small cylinder of platinum at the bottom of a tall glass vessel, and covered it with mercury. The vessel was then placed in a sand-bath, and the mercu-

ry kept constantly boiling. The mercury gradually combined with the platinum; the weight of the cylinders was doubled, and it became brittle. When heated strongly, the mercury evaporated, and left the platinum partly oxidized. It is remarkable that the platinum, notwithstanding its superior specifick gravity, always swam upon the surface of the mercury, so that Morveau was under the necessity of fixing it down.

There are few metallick substances that exceed mercury in utility. In physicks, it is employed in its metallick form—in the construction of meteorological instruments, and a great number of machines in the arts; it is employed in the same form for gilding, silvering of glass mirrors, and in metallurgical operations; its solutions are used in dyeing.

In chymistry, it is applied to a great variety of uses, all equally important. Besides the experiments in which it is employed for demonstrating the principal truths of this science, it has become of indispensable necessity for furnishing the vessels destined to collect, preserve and combine many of the gases.

It is of equal importance for medicinal purposes.

Copper.—Copper is one of those metals which were known in the most early ages of the world, and has at all times been one of the most easy to extract and manufacture. The Egyptians employed it for a variety of uses, and made of it cast figures, remarkable for their elegant form, in the remotest times of their history. The Greeks manufactured it, melted it, cast it, and employed it in various arts. With them it made the base of the celebrated compounds called Corinthian Brass. The Romans likewise manufactured it in great quantity; and it has even been imagined, that the greater number of their utensils were always made with this metal, and very rarely with iron. This circumstance has been urged as a valid proof that they knew little of iron, and were unskilful in manufacturing it.

The alchymists employed themselves much about copper. They called it *Venus*, on account of the great facility it possesses of combining with many substances, particularly with other metals, and because of the sort of adulteration it makes in these compounds.

By representing it by the emblem appropriated to gold, terminated at bottom by the sign of a cross, they considered it as formed chiefly of gold, but disguised and altered by something acrid and corrosive, which rendered it crude. Though, in the different periods of the great revolution, which has changed the face of chymistry, we cannot find any researches concerning copper that are immediately connected with the annals of this revolution, or have served to lay the foundation of it, yet this metal holds a rank among those substances, of which the properties are better known, and the modifications have been more accurately determined since the establishment of the pneumatick doctrine. In this class of properties, accurately explained by the modern theory, we ought particularly to place its different degrees of oxidation, its solutions in acids and in ammonia, its precipitates from the metallick state to its highest degree of oxidation, and its reduction by various processes. The labours of Berthollet, Guyton, and Proust, have particularly contributed to the accurate knowledge of these last mentioned facts. Our knowledge of this metal has also become much more complete, and the facts concerning it by far more simple, since the discoveries which have been lately made in experimental chymistry. It holds almost the third rank among metals in this respect. With regard to its elasticity, it holds nearly the same rank. Its ductility has led Guyton to place it in the sixth rank of metals, between tin and lead. It may be reduced into laminæ, or leaves extremely thin, which the wind will blow away. Its tenacity likewise is pretty considerable: a copper wire, one-tenth of an inch in diameter, supports a weight of $290\frac{1}{4}$ pounds, without breaking. Its strength or resistance to being broken is estimated by Wallerius as nearly equal to that of iron. Its sonorous quality is superior to that of iron, as may be proved by wires of the two metals of equal length and thickness.

This metal is of a fine red colour, and has a great deal of brilliancy. Its taste is styptick and nauseous; and the hands, when rubbed for some time on it, acquires a peculiar and disagreeable odour.

The density of copper is such, that its specifick gravity is to that of water as 7·788 to 1·000. This gravity, however, varies according to the state of the metal: when it has only been melted and cast, it is less than when it has been hammered and forged; but after having passed through the mill, and been drawn into wire, it has the

specifick gravity of 8·878, which is an increase of about one-seventh.

Its power of conducting calorick has not been accurately ascertained, though it is known to be very great. It does not melt till it is very red. Its fusibility has been estimated by Mortimer at 1450° of Fahrenheit's thermometer, and by Guyton at 27° of the pyrometer of Wedgewood. When it is melted and cast into ingot-moulds, that it may cool quickly, it assumes a granulous and porous texture, which shows like a kind of *crumb* in its fracture, and is liable to exhibit many cavities and flaws in its interior parts. If it be cooled slowly, it yields crystals in quadrangular pyramids, or in octahedrons, which arise from the cube, its primitive form. At a temperature above what is required for its fusion, it rises in vapour, and in a visible smoke, as is observed in places where this metal is cast in the large way, and in the chimneys over the furnaces.

Copper is a very good conductor of electricity and galvanism; but its order and power in this respect, compared with that of other metallick substances, has not yet been determined with precision. The acrid and somewhat fetid smell which pretty sensibly characterizes and distinguishes copper, is well known to every one. Rubbing the hand a little time on it is sufficient to impart this coppery odour, to which some other phenomena of the organ of smell have even been compared, particularly that of a *cold in the head.*

Copper is pretty abundantly diffused throughout nature. Germany, Sweden, and Siberia, however, are the three countries, where it has hitherto been found in the largest quantity, and which furnish the most to commerce and the arts. The states of this metal in the earth are so various in their appearance, and in their physical properties, that mineralogists have singularly multiplied the species of it; some have admitted fifteen or twenty, though it is difficult to reckon nine or ten really different from each other in their nature. What they have taken for species are only varieties.

Native copper is met with pretty frequently in the interior parts of the earth, where it is even found very pure. It is known by its brilliancy, its red colour, its ductility, and its specifick gravity. Most commonly its surface is of an obscure dull and brown red, on account of the slight oxidation it has experienced. Sometimes it is found shining, and as if it had been burnished or polished; but this is much more rare than the preceding. Its form is frequently crystalline and regular; that of Siberia distinctly exhibits the cubick figure.

The places where native copper is most frequently observed, are Siberia, Norberg in Sweden, Newsol in Hungary, and Saint-Bel, near Lyons.

Copper exposed to cold air, and particularly to damp air, soon loses its lustre; it tarnishes, becomes of a dull brown, grows gradually darker, acquires what is called the colour of antique bronze, and at last becomes covered with a sort of green tint, tolerably bright, known to every one by the name of *verdigris*, or *verdet gris*, as the modern French chymists will have it.

The atmospherick oxygen begins by converting the surface of the metal into brown oxide; this oxidation is favoured and accelerated by water. The carbonick acid soon unites itself with the copper thus oxidized; so that the kind of varnish of antique medals, statues, and utensils of various kinds, which antiquaries prize in them, and which they call *patine*, is nothing but a true superoxygenated carbonate of copper, very analogous to malachite or mountain green.

This alteration of copper is much more powerful and rapid, if the temperature of the metal be increased. Every one may have observed how quickly the copper tunnels, used for carrying off the smoke of stoves, change their colour from the moment they are first heated, even slightly, in contact with the air: they speedily assume a blueish, orange, yellowish, or brown tinge, which at length becomes wholly of an uniform deep brown over all the surface. These different and very beautiful hues are obtained even by cautiously exposing on burning coals thin plates of laminæ of copper, as well as that which is in light leaves. By this process, leaves of a sort of *foil* are made of various colours, which are chiefly used, after being cut into small pieces, for covering children's toys, to which they are fastened by a kind of mordant or cement, previously applied on them. In fabricating these, the succession of blue, yellow, violet, and brown, may be observed; the last colour too is that which remains, and is permanent.

When the action of fire on copper is strongly urged; when it is thrown, for instance, in the form of fine filings, into a very strong fire, or when it is heated in a

crucible to a white heat after having been melted, it burns much more rapidly than in the former cases; it experiences a real conflagration; it even yields a very brilliant green flame. Accordingly, it is employed in the composition of the coloured fires of the smaller kinds of fireworks, particularly those which are called table fireworks. The same effect which is perceptible at the surface of the crucible in which copper, thoroughly fused and very red, if melted and stirred, is produced by sending through this metal, in a small piece, or in wire, or in thin leaves, an electrick discharge. It instantly emits a greenish flame, breaks with decrepitation, and is dispersed in smoke or dust in the air. It may be collected on paper, and will be found covered with a reddish brown oxide. It is to this property likewise we are indebted for the green colour which we so frequently see in the flame of several combustible substances, but particularly alcohol, when cupreous salts have been dissolved in it. Notwithstanding the activity of this sort of combustion, and its difference from the slow oxidation already described, the oxide resulting from it uniformly contains but twenty-five parts of oxygen to an hundred of the metal, and completely resembles that which is obtained by the former kind of combustion.

AURORA BOREALIS.

We often see in the north, near the horizon, usually a short time after sunset, a dark segment of a circle, surrounded by a brilliant arch of white or fiery light; and this arch is often separated into several concentrick arches, leaving the dark segment visible between them. From these arches, and from the dark segment itself, in high latitudes, columns of light, of the most variegated and beautiful colours, shoot up towards the zenith, and, sometimes, masses like sheaves of light are scattered in all directions. The appearance is then splendid; and its increasing beauty is announced by a general undulation of the masses of light. A kind of fiery coronet is afterwards formed about the zenith, by the meeting of all the columns of light, resembling the knob of a tent. At this moment, the spectacle is magnificent, both for the multiplicity and beauty of the columns which the aurora presents. The light, after this, grows fainter and more tranquil. This faintness and tranquillity, however, are only temporary, for the phenomena are soon repeated in all their beauty—the oscillation of the columns of light, the formation of the corona, and the like, though with a thousand variations. At length, the motion wholly ceases, the light is collected about the northern horizon, the dark segment vanishes, and nothing is left but a strong brightness, in the north, which is lost in the dawning day. These brilliant appearances are also attended, in high latitudes, with loud noises, described as resembling the hissing and crackling of fire-works. This appearance has received the name of *northern light*, because, on account of our position on the earth, we see it only about the north pole. A similar appearance, *aurora australis*, was seen about the south pole, in 1773, by Cook's sailors, between 58° and 60° S. lat., and later travellers have observed the same. These phenomena ought, therefore, properly to be called *polar lights*. Philosophers are of different opinions as to the cause of the aurora. It is, however, satisfactorily ascertained to be within the region of our atmosphere. Hell ascribed it to the reflection of the sun and moon by the clouds of snow and needles of ice, which are constantly floating in the atmosphere of the frigid zones. Mairan supposed it to proceed from the atmosphere of the sun. Bailly ascribed it to magnetism, and its remarkable influence on the needle has been generally observed. Biot, who was sent to the Shetland Islands, in 1817, by the French Academy of Sciences, to determine the length of the pendulum vibrating seconds, had an opportunity, Aug. 27, of the same year, of observing the Aurora Borealis, in all its splendour, at the Island of Unst. On this occasion, he ascribed to the phenomenon a volcanick origin, and his reasoning is given at length in the *Journal des Savans* for 1820. An ingenious hint of Kastner is deserving of attention. He considers polar lights as the electricity of the earth rising periodically to the poles.

Dr. Halley imagines that the watery vapours or effluvia, exceedingly rarefied by subterraneous fire, and tinged with sulphureous streams, which many naturalists have supposed to be the cause of earthquakes, may also be the cause of this appearance; or that it is produced by a kind of subtile matter freely pervading the pores of the earth, and which, entering into it nearer the southern pole, passes out again with some force into the other, at the same distance from the northern. This subtile matter, by becoming more dense, or having

its velocity increased, may perhaps be capable of producing a small degree of light, after the manner of effluvia from electrick bodies, which, by a strong and quick friction, emit light in the dark; to which sort of light this seems to have a great affinity. Philos. Trans. No. 347. See also Mr. Cotes's description of this phenomenon, and his method of explaining it by streams emitted from the heterogeneous and fermenting vapours of the atmosphere, in Smith's Optics, p. 69; or Philos. Trans. abr. vol. 6, part 2.

Mr. Canton, soon after he had obtained electricity from the clouds, offered a conjecture that the Aurora is occasioned by the dashing of electrick fire positive toward negative clouds at a great distance, through the upper part of the atmosphere, where the resistance is least; and he supposes that the Aurora which happens at the time when the magnetick needle is disturbed by the heat of the earth, is the electricity of the heated air above it: and this appears chiefly in the northern regions, as the alteration in the heat of the air in those parts is the greatest. Nor is this hypothesis wholly improbable, when it is considered that electricity is the cause of thunder and lightning; that it has been extracted from the air at the time of the Aurora Borealis; that the inhabitants of the northern countries observe it remarkably strong when a sudden thaw succeeds very cold severe weather; and that the tourmalin is known to emit and absorb the electrick fluid only by the increase or diminution of its heat.

Positive and negative electricity in the air, with a proper quantity of moisture to serve as a conductor, will account for this and other meteors sometimes seen in a serene sky. Mr. Canton afterward contrived to exhibit this meteor by means of the Torricellian vacuum, in a glass tube about three feet long, and sealed hermetically. When one end of the tube is held in the hand, and the other applied to the conductor, the whole tube will be illuminated from end to end, and will continue luminous without interruption for a considerable time after it has been removed from the conductor. If, after this, it is drawn through the hand either way, the light will be remarkably intense through the whole length of the tube. And, though a great part of the electricity is discharged by this operation, it will still flash at intervals, when held only at one extremity, and kept quite still; but if, at the same time, it is grasped by the other hand in a different place, strong flashes of light will dart from one end to the other; and these will continue 24 hours or more, without a fresh excitation. Sig. Beccaria conjectures that there is a constant and regular circulation of the electrick fluid from north to south; and he thinks that the Aurora Borealis may be this electrick matter performing its circulation in such a state of the atmosphere as renders it visible, or approaching nearer than usual to the earth: though probably this is not the mode of its operation, as the meteor is observed in the southern hemisphere with the same appearances as in the northern. Dr. Franklin supposed that the electrick fire discharged into the polar regions, from many leagues of vaporized air raised from the ocean between the tropicks, accounts for the Aurora Borealis; and that it appears first where it is first in motion, namely, in the most northern part; and the appearance proceeds southward, though the fire really moves northward.

The extent of these appearances is also amazingly great. That in March, 1716, was visible from the west of Ireland to the confines of Russia and the East of Poland, extending at least near 30 degrees of longitude, and from about the 50th degree in latitude over almost all the north of Europe; and in all places, at the same time, it exhibited the like wondrous appearances.

Father Boscovich has determined the height of an Aurora Borealis, which was observed by the Marquis of Polini the 16th of December, 1737, and found it was 825 miles high; and Mr. Bergmann, from a mean of 30 computations, makes the average height of the Aurora Borealis amount to 70 Swedish, or 469 English miles. But Euler supposes the height to be several thousands of miles; and Marian also assigns to them a very elevated region.

In Sweden and Lapland the Aurora Borealis are not only singularly beautiful, but afford travellers, by their almost constant effulgence, a very fine and brilliant light during the whole night. In Hudson's bay, the light of the Aurora Borealis is said to be equal to that of a full moon; and in the north-eastern parts of Siberia, we are told, these northern lights are observed to begin with single bright pillars, rising in the north, and almost at the same time in the north-east, which, gradually increasing, comprehend a large space of the heavens, rush about from place to place with incredible velocity, and finally almost cover the whole

sky up to the zenith, and produce an appearance in the heavens of a vast expanded tent, glittering with gold, rubies and sapphire. A more interesting spectacle cannot be conceived; but whoever sees such a northern light for the first time could not behold it without terror. For however fine the illumination may be, it is attended, as it is said, with a hissing noise through the air, as if the largest fireworks were playing off. To describe what they then hear, the natives make use of the expression *spolchi chodjat*, that is, the raging host is passing. The hunters who pursue the foxes are frequently overtaken with these lights; and their dogs are then so much terrified, that they will not move, but lie obstinately on the ground till the noise is passed. See Philos. Trans. vol. lxxiv.—(Drs. Lieber & Gregory.)

EFFECTS OF SEA-AIR.

Those who frequent the sea-coasts are not long in discovering that their best dyed black hats become of a rusty brown; similar effects are produced on some other colours. The brown is, in fact, rust. Most if not all, the usual black colours have iron for a basis, the black oxide of which is developed by galls, logwood, or other substances containing gallic acid. Now the sea-air, contains a proportion of the muriates over which it is wafted; and these coming into contact with any thing dyed black, part with their hydrochloric (muriatic) acid, and form brown hydrocholate of iron, or contributed to form the brown or red oxide, called rust. The gallic acid, indeed from its superior affinity, has the strongest hold of the iron; but the incessant action of the sea-air, loaded with urimates, partially overcomes this, in the same way as any acid, even of inferior affinity to the gallic, when put upon black stuff, will turn it brown.

CRYPTOGRAPHY.

Cryptography (from the Greek *κρυπτος*, secret, and *γραφειν*, to write ;) the art of transmitting secret information by means of writing, which is intended to be illegible, except by the person for whom it is destined. The ancients sometimes shaved the head of a slave, and wrote upon the skin with some indelible coloring matter, and then sent him, after his hair had grown again, to the place of his destination. This is not, however, properly secret writing but only a concealment of writing. Another sort, which corresponds better with the name, is the following, used by the ancients. They took a small stick, and wound around it bark, or papyrus, upon which they wrote. The bark was then unrolled, and sent to the correspondent, who was furnished with a stick of the same size. He wound the bark again round this, and thus was enabled to read what had been written. This mode of concealment is evidently very imperfect. Cryptography properly consists in writing with signs, which are legible only to him for whom the writing is intended, or who has a key, or explanation of the signs. The most simple method is to choose for every letter of the alphabet some sign, or only another letter. But this sort of cryptography (*chiffre*) is also easy to be deciphered without a key. Hence many illusions are used. No separation is made between the words, or signs of no meaning are inserted among those of real meaning. Various keys likewise are used, according to rules before agreed upon. By this means, the deciphering of the writing becomes difficult for a third person, not initiated; but it is likewise extremely troublesome for the correspondents themselves; and a slight mistake often makes it illegible, even by them. Another mode of communicating intelligence secretly, viz., to agree upon some printed book, and mark the words out, is also troublesome, and not at all safe. The method of concealing the words which are to convey the information intended in matter of a very different character, in a long letter which the correspondent is enabled to read, by applying a paper to it, with holes corresponding to the places of the significant words, is attended with many disadvantages: the paper may be lost; the repetition of certain words may lead to discovery; and the difficulty of connecting the important with the unimportant matter, so as to give the whole the appearance of an ordinary letter, is considerable. If this is effected, however, this mode has the advantage of concealing the fact that any secrecy is intended. Writing with sympathetick ink, or milk, lemon-juice, &c., is unsafe, because the agents to make the letters visible are too generally known. Hence the *chiffre quarré* or *chiffre indéchiffrable*, so called, has come very much into use, because it is easily applied, difficult to be deciphered, and the key may be preserved in the memory merely, and easily changed. It consists of a table, in which the letters of the alphabet, or any other signs agreed upon are arranged under one another, thus :—

z	a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a
b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b
c	d	e	f	g	h	i	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c
d	e	f	g	h	i	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d
e	f	g	h	i	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e
f	g	h	i	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f
g	h	i	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g
h	i	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h
i	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i
k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i	k
l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i	k	l
m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i	k	l	m
n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i	k	l	m	n
o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i	k	l	m	n	o
p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i	k	l	m	n	o	p
q	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q
r	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r
s	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r	s
t	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r	s	t
u	v	w	x	y	z	a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r	s	t	u
v	w	x	y	z	a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r	s	t	u	v
w	x	y	z	a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r	s	t	u	v	w
x	y	z	a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r	s	t	u	v	w	x
y	z	a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y
z	a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z

Any word is now taken for a key; *Paris*, for example. This is a short word, and for the sake of secrecy, it would be well to choose for the key some one or more words less striking. Suppose we wish to write in this cypher, with this key, the phrase "We lost a battle;" we must write *Paris* over the phrase, repeating it as often as is necessary, thus:—

P a risP a risPar
We lost a battle.

We now take, as a cypher for *w*, the letter which we find in the square opposite *w* in the left marginal column, and under *p* on the top, which is *m*. Instead of *e*, we take the letter opposite *e* and under *a* which is *f*; for *l*, the letter opposite *l* and under *r*, and so on. Proceeding thus, we should obtain the following series of letters:—

mfcxlibtkmimw

The person who receives the epistle writes the key over the letters; as,

P a r i s P a r i s P a r
m f c x l i b t k m i m w

He now goes down in the perpendicular line, at the top of which is *p*, until he meets *m*, opposite to which, in the left marginal column, he finds *w*. Next, going in the line of *a* down to *f*, he finds on the left *e*. In the same way, *r* gives *l*, *i* gives *o*, and so on. Or you may reverse the process; begin with *p*, in the left marginal column, and look along horizontally till you find *m*, over which, in the top line, you will find *w*. It is easily seen, that the same letter is not always designated by the same cipher; thus, *e* and *a* occur twice in the phrase selected, and they are designated respectively by the cyphers *f* and *w*, *b* and *k*. Thus the possibility of finding out the secret writing is almost excluded. The key may be changed from time to time, and a different key may be used with each correspondent. The utmost accuracy is necessary, because one character, accidentally omitted, changes the whole

cypher. The correspondent, however, may ascertain this with considerable trouble.—(Am. Encyclopædia.)

STRENGTH OF LEADEN PIPES.

Experiments on this subject have been made at Edinburg, by Mr. Jardine, at the Water Company's yard. The method followed was to close one end of a piece of pipe, and then throw water into it by a forcing pump attached to the other end, the force or pressure being measured by a guage belonging to the pump. When the water from the injecting pump first begins to press out the pipe, little or no alteration is observed on it for some time. As the operation proceeds, however, the pipe gradually swells throughout its whole length, until at last a small protuberance is observed rising in some weak part, which increases until the substance of the pipe, becoming thinner and thinner, is at last rent asunder, when the pipe breaks with a crash, and the water issues with great violence.

In the first experiment, the pipe was of one and a half inch bore, and the metal, which was remarkably soft and ductile, one fifth of an inch in thickness. This sustained a power equivalent to that of a column of water one thousand feet high, equal to thirty atmospheres, or four hundred and twenty pounds per square inch of internal surface, without alteration; but with a pressure of water equal to twelve hundred feet of water, it began to swell, and with fourteen hundred feet, or six hundred pounds on the square inch, it burst. When measured after the experiment, it was found to have swelled until it became of a diameter of one and three-fourths of an inch. The edges of the fracture were not ragged, but smooth and sharp like a knife.

In the second experiment, the pipe was two inches in diameter, and one fifth of an inch in thickness. It sustained a pressure equal to that of a column of water eight hundred feet in height, with hardly any swelling, but with one thousand feet it burst. The fracture here was not so fine as in the former pipe, the metal being much less ductile.—(Caledonian Mercury.)

ATMOSPHERICAL ELECTRICITY.

Air is one of those bodies which have received the name of *electricks*, because they are capable of being positively or negatively charged with electrick matter. It not only contains that portion of electricity which seems necessary to the constitution of all terrestrial bodies, but it is liable also to be charged negatively or positively when electricity is abstracted or introduced by means of conducting bodies. These different states must occasion a variety of phenomena, and in all probability contribute very considerably to the various combinations and decompositions which are continually going on in the air. The electrical state of the atmosphere, then, is a point of considerable importance, and has with great propriety occupied the attention of philosophers ever since Dr. Franklin demonstrated that thunder is occasioned by the agency of electricity.

The most complete set of observations on the electricity of the atmosphere were made by Professor Beccaria of Turin. He found the air almost always positively electrical, especially in the day-time and in dry weather. When dark or wet weather clears up, the electricity is always negative. Low thick fogs rising into dry air carry up a great deal of electrick matter.

In the morning, when the hygrometer indicates dryness equal to that of the preceding day, positive electricity obtains even before sun rise. As the sun gets up, this electricity increases more remarkably if the dryness increases. It diminishes in the evening.

The mid-day electricity of days equally dry is proportional to the heat.

Winds always lessen the electricity of a clear day, especially if damp.

For the most part, when there is a clear sky and little wind, a considerable electricity arises after sunset at dew falling.

Considerable light has lately been thrown upon the sources of atmospherical electricity by the experiments of Saussure, Humboldt, and other philosophers. Air is not only electrified by friction like other electrick bodies, but the state of its electricity is changed by various chymical operations which often go on in the atmosphere. Evaporation seems in all cases to convey electrick matter into the atmosphere; and Saussure has ascertained that the quantity of electricity is much increased when water is decomposed, as when water is dropt on a red hot iron. On the other hand, when steam is condensed into vesicular vapour, or into water, the air becomes negatively electrick. Hence it would seem that electricity enters as a component part into water; that it separates when water is decomposed or expanded into steam, and is

re-united when the steam is condensed again into water.

Mr. Canton has ascertained that dry air, when heated, becomes negatively electrick, and positive when cooled, even when it is not permitted to expand or contract: and the expansion and contraction of air also occasions changes in its electrick state.

Thus there appears to be at least four sources of atmospherick electricity known; namely, Friction; Evaporation; Heat and cold; Expansion and Contraction: not to mention the electricity evolved by the melting, freezing, solution, &c. of various bodies in contact with air.

As air is an electrick, the matter of electricity, when accumulated in any particular strata, will not immediately make its way to the neighbouring strata, but will induce in them changes similar to what is induced upon plates of glass or similar bodies piled upon each other. Therefore if a stratum of air be electrified positively, the stratum immediately above it will be negative, the stratum above that positive, and so on. Suppose now that an imperfect conductor were to come into contact with each of these strata, we know, from the principles of electricity, that the equilibrium would be restored, and that this would be attended with a loud noise, and with a flash of light. Clouds which consist of vesicular vapours mixed with particles of air are imperfect conductors; if a cloud therefore come into contact with two such strata, a thunder-clap would follow. If a positive stratum be situated near the earth, the intervention of a cloud will serve to bring the stratum within the striking distance, and a thunder-clap will be heard while the electrical fluid is discharging itself into the earth. If the stratum be negative, the contrary effects will take place.

It has been proved by Mr. Canton that dry air, when heated, becomes negatively electrified, but that it assumes the positive state when cooled. He has also shewn that it undergoes changes in its electrical condition as it is exposed to various degrees of pressure; and Beccaria, Cavallo, Achard, and other experimental enquirers, have ascertained that these changes are connected with meteorological phenomena.

On this subject we quote the following observations from Humboldt, which that illustrious traveller made in the valleys of Aragua; "Being sufficiently habituated to the climate," says he, "not to fear the effects of tropical rains, we remained on the shore to observe the electrometer. I held it more than twenty minutes in my hand, six feet above the ground, and observed that, in general, the pith balls separated only a few seconds before the lightning was seen. The separation was four lines. The electrick discharge remained the same during several minutes; and having time to determine the nature of the electricity, by approaching a stick of sealing wax, I saw here on the plain what I have often observed on the back of the Andes, during a storm, that the electricity of the atmosphere was first positive, then null, and then negative. These oscillations from the positive to the negative state were often repeated." "We had already observed," he adds, "in valleys of Aragua, from the 18th and 19th of February, clouds forming at the commencement of the night. In the beginning of the month of March the accumulation of the vesicular vapours became visible to the eye, and with them signs of atmospherick electricity augmented daily. We saw flashes of lightning to the South, and the electrometer of Volta displayed constantly at sun set positive electricity. The separation of the little pith balls null during the rest of the day, was from three to four lines at the commencement of the night; which is triple what I generally observed in Europe with the same instrument in calm weather." Again he remarks, "about the end of February and the beginning of March, the blue of the sky is less intense, the hygrometer indicates by degrees greater humidity, the stars are sometimes veiled by a thin stratum of vapours, and their light is no longer steady and planetary; they are seen twinkling from time to time 20° above the horizon. The breeze at this period, becomes less strong, less regular, and is often interrupted by dead calms."

For guarding against accidents from lightning, Dr. Franklin's great invention of metallick conductors may be very advantageously employed; for, when properly fixed, they afford a degree of security, which leaves very little room for apprehension. A conductor ought to be continued deep into the earth, or connected with some well or drain; it should be of ample dimensions, and where smallest, of copper, since copper conducts electricity more readily than iron. In one instance a conductor of iron, four inches wide, and half an inch thick, appears to have been made red hot by a stroke of lightning. It seems to be of some advantage that a conductor should

be pointed, but the circumstance is of less consequence than has often been supposed. Mr. Wilson exhibited some experiments in which a point was struck at a greater distance than a ball, and therefore argued against the employment of pointed conductors. Mr. Nairne, on the contrary, showed that a ball is often struck in preference to a point. But it has been observed, that if a point attracts the lightning from a greater distance, it must protect a greater extent of building. It is easy to show, by hanging cotton or wool on a conductor, that a point repels light electrical bodies, and that a pointed conductor may, therefore, drive away some fleecy clouds; but this effect is principally derived from a current of air repelled by the point; and such a current could scarcely be supposed to have any perceptible effect upon clouds so distant as those which are concerned in thunder storms.

A small quantity of metal is found to conduct a great quantity of this fluid. A wire no bigger than a goose-quill, has been known to conduct (with safety to the building, as far as the wire was continued,) a quantity of lightning that did prodigious damage both above and below it; and probably larger rods are not necessary, though it is common in America, to make them of half an inch, and some of three quarters, or an inch in diameter.

The rod may be fastened to the wall, chimney, &c. with staples of iron. The lightning will not leave the rod (a good conductor,) to pass into the wall, (a bad conductor,) through those staples.—It would rather, if any were in the wall, pass out of it into the rod to get more readily by that conductor into the earth.

If the building be very large and extensive, two or more rods may be placed at different parts for greater security.

Small ragged parts of clouds suspended in the air, between the great body of clouds and the earth, (like leaf gold in electrical experiments,) often serve as partial conductors for the lightning, which proceeds from one of them to another, and by their help comes within the striking distance to the earth or a building. It therefore strikes through those parts of a building that would otherwise be out of the striking distance.

It is therefore proper to elevate the upper end of the rod six or eight feet above the highest part of the building, tapering it gradually to a fine sharp point, which should be gilt to prevent its rusting.

The pointed rod will thus either prevent a stroke from the cloud, or, if a stroke takes place, will conduct it to the earth with safety to the building.

A person apprehensive of danger from lightning, happening, during the time of thunder, to be in a house not so secured, will do well to avoid sitting near the chimney, looking-glass, gilt pictures, or wainscoat; the safest place is in the middle of the room, (if not under a metal lustre, suspended by a chain,) sitting on one chair and laying the feet on anothe.. It is still safer to bring two or three mattrasses or beds into the middle of the room, and folding them up double, place the chair upon them; for they not being so good conductors as the walls, the lightning will not choose an interrupted course through the air of the room and the bedding, when it can go through a continued better conductor, the wall. But where it can be had, a hammock or swinging bed, suspended by silk cords equally distant from the walls on every side, and from the ceiling and floor above and below, affords the safest situation a person can have in any room whatever; and what indeed may deemed quite free from danger of any stroke by lightning.—(Artisan.)

The following sketch is from Professor Silliman's Journal.

DESCENT FROM MAUCH CHUNK* COAL MINE.

The coal is conveyed to Mauch Chunk village, in wagons running upon the railway. Fourteen of them, containing each one ton and a half of coal, are connected by iron bars, admitting of a slight degree of motion between two contiguous wagons; a single man rides on one of the wagons, and by a very simple contrivance regulates their movement: a perpendicular lever causes a piece of wood to press against the circumference of each wheel on the same side of the car, acting both ways from the central point between them, so that by increasing the pressure, the friction retards or stops the motion, and as all the levers are connected by a rope they are made to act in concert. The traveller is much interested in seeing the successive groups of wagons moving rapidly in procession and without apparent cause;

* *Mauch Chunk*, is the Indian name, and means *Bear Mountain*, as bears are said to have been anciently numerous there and are still found there, occasionally, as well as panthers.

they are heard, at a considerable distance, as they come thundering along with their dark burdens and give an impression of irresistible energy: at a suitable distance follows another train, and thus three hundred tons a day, and some days three hundred and forty tons,* are regularly discharged into the boats lying in the river. At first they descended at the rate of fifteen or twenty miles an hour, but they were obliged to reduce the speed, as it injured the machines, and by agitating and wearing the coal, involved the driver in a cloud of black dust. The empty wagons are drawn back by mules; fourteen wagons to eight mules; twenty-eight mules draw up forty-two coal and seven mule wagons, and the arrangement is so made that the ascending parties shall arrive in due season at the proper places for turning out. The same is true of the pleasure cars, which are allowed to use the railway; only they must not interfere with its proper business, and should they do it, it would be at their peril, as they might be crushed by the momentum of the descending wagons. When they happen to be caught out of their proper place, the drivers make all possible haste to remove them out of the railway track, but they carefully avoid these meetings, and they rarely happen, unless the cars go out of their proper time.

The mules ride down the railway; they are furnished with provender placed in proper mangers, four of them being enclosed in one pen, mounted on wheels; and seven of these cars are connected into one group, so that twenty-eight mules constitute the party, which, with their heads all directed down the mountain, and apparently surveying its fine landscapes, are seen moving rapidly down the inclined plane with a ludicrous gravity, which, when observed for the first time, proves too much for the severest muscles.

They readily perform their duty of drawing up the empty cars, but having once experienced the comfort of riding down, they appear to regard it as a right, and neither mild nor severe measures, not even the sharpest whipping, can ever induce them to descend in any other way.

The return of the traveller, in the pleasure cars, is so rapid that it is not easy entirely to suppress the apprehension of danger; we performed the eight miles from the summit in thirty-three minutes, should an axle-tree break—an accident which sometimes happens with the coal wagons—it would be impossible that the passengers should escape unhurt, especially in the turnings of the road and in places where trees, rocks and precipices allow no safe place of landing. All danger would however be avoided by checking the motion, so that it should not exceed eight or ten miles an hour, and this is easily done in the same way as that practised in the coal wagons. Happily no accident has yet occurred. It would be prudent at least to require the manager to check the motion of the car at the steepest places; but these are the very situations where he chooses to make a display of cracking his whip and cheering his wheels, instead of his horses, and the increased impulse, given by gravity, as he relaxes the pressure of the lever, when the car springs forward like spirited horses at the word of their master, makes the illusion almost complete. †

On the whole, whether we regard scenery, science, comfort, amusement, or health, Mauch Chunk may be presented to every intelligent traveller as a point of peculiar attraction and gratification, and its extraordinary combination of rare and strange features, grouped in a wild and almost savage spot, partially softened and subdued into civilization and comfort by man, cannot fail to excite and to satisfy an increasing publick curiosity.

* *One day's work at Mauch Chunk, between Sun rise and half past four, P. M.*—Three hundred and forty tons of coal quarried at the Mines, loaded and brought on the rail road, nine miles—unloaded from the wagons down the chute, and loaded into boats. The *boats* for this coal *all built* the same day and within the above mentioned time. Forty thousand feet of lumber sawed in one day and night. They create the freight, and build and load the vessels all on the same day.

† The proprietor informs us, that the pleasure cars generally do not go so fast as is mentioned in the text; they are carefully and frequently inspected, and they are made of a strength which places them beyond the danger of breaking, by ordinary use;—when going at the rate of twenty miles an hour, they can be stopped within a distance of fifty or one hundred feet, by the breaks attached to them.

VELOCITY OF SOUND.

By experiments, we know that sound travels 1142 feet in a second, or 13 miles a minute: water accelerates its velocity; and all sounds travel at the same rate; the softest whisper flies with the speed of the loudest thunder. The velocity of sound is to that of a brisk wind as fifty to one.

The velocity of sound has been applied to the measurement of distances.

A ship at sea in distress fires a gun, the light of which is seen on shore 20 seconds before the report is heard, therefore it is known to be at the distance of 20 times 1142 feet, or little more than $4\frac{1}{2}$ miles. I see a vivid flash of lightning; and if in three seconds I hear a tremendous clap of thunder, I instantly know that the thunder cloud is only two-thirds of a mile distant. I should therefore retire instantly from any exposed situation. The pulse of a healthy person beats about 76 times in a minute; if, therefore, between the flash of lightning and the thunder I can feel 1, 2, 3, 4, &c. beats of my pulse, I know the cloud is 900, 1800, 2700, 3600 feet from me.

Smooth and clear sounds proceed from bodies that are homogeneous, and of an uniform figure: harsh and rough, or obtuse sounds, from irregular bodies, or such as are made of mixed matter. The strength of sounds is greatest in cold and dense air; and least in that which is warm and rarefied. And under an exhausted receiver, a bell gives no sound. Every point against which the pulses of sound strike, becomes a centre from which a new series of pulses are propagated in every direction. Hence the extraordinary echoes* we sometimes hear.

*For an echo to be heard, the ear must be in the line of reflection; that the person who made the sound may hear the echo, it is necessary he should be in a perpendicular line to the place which reflects it; and for a multiple or tautological echo, it is necessary there should be a number of walls and vaults, rocks and cavities, either placed behind or fronting each other. Those murmurs in the air, occasioned by the discharge of great guns, &c. are a kind of indefinite echoes, and are produced from the vaporous particles suspended in the atmosphere, which resist the modulations of sound, and reverberate them to the ear.

There can be no echo unless the direct and reflex sounds follow one another at a sufficient distance of time; for if the reflex sound arrives at the ear before the impression of the direct sound ceases, the sound will not be doubled, but only rendered more intense. Now if we allow that 9 or 10 syllables can be pronounced in a second, in order to preserve the sounds articulate and distinct, there should be about the 9th part of a second between the times of their appulse to the ear; or, as sound flies about 1142 feet in a second, the said difference should be 1-9th of 1142, or 127 feet; and therefore every syllable will be reflected to the ear at the distance of about 70 feet from the reflecting body; but as in the ordinary way of speaking, 3 or 4 syllables only are uttered in a second, the speaker, that he may have the echo returned as soon as they are expressed, should stand about 500 feet from the reflecting body, and so in proportion for any other number of syllables. Mersenne allows for a monosyllable the distance of 69 feet. Morton 90 feet; for a dissyllable, 105; a trissyllable, 160; a tetrasyllable, 182; and a pentasyllable, 204 feet.

Echoes have been applied for measuring inaccessible distances. Thus, upon the banks of the Thames, opposite to Woolwich, a single sound was reflected back from the houses in 3 seconds; consequently the sum of the direct and reflex rays must have been $1142\times3=3426$ feet, and the half of it 1713 feet—the breadth of the river in that place.

We shall here mention some of the most remarkable echoes, at present known.

At Milan there is said to be an echo, which reiterates the report of a pistol 56 times, and if the report be exceedingly loud, the reiteration will exceed that number. The celebrated echo at Woodstock, in Oxfordshire, England, repeats the same sound 50 times. But the most singular echo hitherto spoken of, is that near Rosneath, a few miles from Glasgow, Scotland. If a person placed at a proper distance from this echo, plays 8 or 10 notes of a tune with a trumpet, they are correctly repeated by the echo, but a 3d lower; after a short pause, another repetition is heard, in a lower tone; and then, after another interval, a third repetition follows in a still lower tone.

At a ruined fortress near Louvain, in Flanders, there is an echo, which, if a person sung, he heard only his own voice, without any repetition; on the contrary, those who stood at some distance heard the echo, but not the voice; but then they heard it with surprising variations, sometimes louder, sometimes softer, now more near, then more distant.

At the sepulchre of Metalla, wife of Crassus, there was an echo, which repeated what a man said 5 times. Authors mention a tower a Cyzicus, where the echo repeated 7 times. There is an echo at Brussels that answers 15 times. On the banks of the Naka, between Coblentz and Bingen, there is an echo which repeats the words of a man 17 times.

Lastly, echoing bodies may be so ordered, that from any one sound given, they shall produce many echoes, different both as to tone and intention: by which means a musical room may be so contrived, that not only one instrument playing in it shall seem many of the same sort and size, but even a concert of different ones; this may be contrived by placing certain echoing bodies so, as that any note played, shall be returned by them in 3ds, 5ths, and 8ths.—(Selected.)

EXPLOSIONS OF STEAM BOILERS.

In July last, the Board of Managers of the Franklin Institute, passed a resolution to institute an investigation into the probable causes of explosions of boilers, and published a Circular to that effect in the Franklin Journal, inviting the attention of the publick, but particularly the scientifick, to this very interesting subject. The November number of their Journal contains the first responses which have been made to the circular.—The first by Mr. Charles Potts, of Philadelphia, the second, (and which we give below,) by Mr. D. J. Burr, of Richmond, Va. We select Mr. B.'s remarks as containing some practical information, and which accord with a generally received opinion, viz: that *too much* steam is the cause of nine explosions out of ten.

Remarks on the frequent Explosions of Steam Engine Boilers in the United States, and on the construction and operation of two boilers now in use.

Sir,—With much pleasure I see announced the determination of the managers of the Institute, to investigate the causes of explosion of steam boilers, and, if possible, to devise some adequate remedy or preventive for an evil so alarming. The occasion is the more urgent, as it seems not improbable that competition induces the owners of "low pressure" boats to encroach somewhat on the prerogative of their *more pressing* compeers; and there is so much temptation to progressive improvement in that particular, that we may expect to hear of, if not to experience, the consequences, in more frequent and horrid detail, from year to year.

It cannot but have occurred to every one conversant with this subject, that while in our country, explosions are frequent and dreadful, we hear of no similar catastrophes in Great Britain; and we are led to inquire, what regulations have been adopted and legalized there? and how far may those rules have contributed to this exemption? If on this point it be said that British steamers are universally of low pressure, it should be recollected that our "low pressures" are not exempted from casualty, and that *theirs* are employed almost exclusively in sea water; and a great proportion of them having iron boilers, it might be apprehended that corrosion would be rapid, and the materials would eventually become deficient, and give way.

The same observation, however, applies with equal truth to high pressure steam in Great Britain; and if the inquiry be made why they are exempt from such terrible disasters as occur in this country, not seldom even on land, the answer may probably be, that *their* high pressure is limited to 50lbs. to the inch, while ours is very commonly three times as great; and as it can hardly be expected that accidents will not sometimes occur, so it must be supposed that as more powerful steam is used, explosions will be more than proportionably frequent and dreadful in their effects.

Provision by law for a strict original survey, and for subsequent frequent proofs, is, perhaps, necessary, and would be most effectual in connexion with such other guards as are obvious, and have often been proposed.

I am aware that what is said above would appear trite if offered to the committee, or to any person well informed on the subject: but this is a matter of publick concern, and the publick need information. No danger is so alarming as that of which we know not the nature and extent; and it is only by a fair exposition of facts that the general excitement and apprehension can be restrained within rational limits.

But the committee want facts, and on a matter of such great importance, it is hoped that no one will withhold any thing calculated to bear on the questions at issue. In giving my small stock of information, I premise that, although familiar with steam for some years past, I *know* nothing of it as used at 150 lbs.; or, indeed, any thing over 50 lbs. to the inch. That it will continue to be used at the highest practicable extreme on our western waters, and wherever freight is a prime object, we need not doubt; but that it will be so employed without ultimate dire disasters from the gradual corrosion and weakening of the boilers, we have no reason to expect. With this impression, however, I cannot but consider the use of such high steam on land, as of very doubtful expediency, involving a risk but poorly compensated by the economical advantage.

I shall now state some facts to prove that the tremendous explosions, now of so frequent occurrence, do result chiefly, if not entirely, from the use of steam of excessive power.

The boiler of a high pressure engine,

(not new,) working at a coal mine in this vicinity, is of wrought iron, $\frac{5}{16}$ thick, and supplied with "copperas" water so slightly impregnated, that it is commonly drank by the workmen. After a few weeks from the commencement, it was discovered that the boiler plate immediately over the fire place was cracked and leaking. The steam was limited by the safety valve to 50 lb. the inch, and the engine at full work; the leak continued for several days without material increase, and the boiler was then repaired with a large and good plate, and it was then ascertained that the front end of the boiler being rather lowest, a considerable deposit similar to iron rust was made at the place where the old plate was burned.

In the course of four or five weeks more, it was perceived that a blister was raised on the new plate, and as the engine could not be dispensed with, and the means for repair were not at hand, the protuberance daily increased until it became, as the fireman expressed it, as large and deep as a hat crown. In about ten days it burst, while at full work, and the iron was found to be attenuated to less than $\frac{1}{8}$ of an inch at the thinnest part. The explosion, if such it can be called, was entirely harmless, no one happening to be at the front end, and neither the boiler nor the bricks of the furnace were disturbed.

The boiler was then taken up, repaired, and improved by adding several transverse pipes of cast iron, on a plan similar to the boilers of Woolfe's engines, in Wales. The engine has been running since, about 6 months, and doing well; the pipes being regularly and conveniently cleaned, and there is no appearance of injury, or apprehension of failure.

What remains of my experience as applicable to the inquiry before us, will be best given by a short description of the peculiarities of a small engine attached to the Richmond foundry, which has been used for 12 months past.

The boiler is a cylinder, to which transverse pipes are attached below by short necks, on the plan mentioned above, but on the whole length; these pipes are covered with fire bricks, and the spaces between the necks are closed. The fire acting first below the pipes, returns above them on one side of their necks, and passes off by the other side. This boiler appears to be in some respects peculiarly safe, viz. the cylinder is not likely to be heated dangerously hot, although it should be quite emptied of water. The pipes which are exposed to the most intense heat, are least likely to be empty, and being weakest, would yield first, probably without injury, except immediately in front of the furnace, and experience has indicated a safeguard against this possible danger. On one occasion, by the negligence of the fireman, the water was suffered to exhaust, until the pipes became empty, and this fact was announced by steam issuing from one end of a pipe where it was found that the pasteboard with which the joint of the cap or cover was made, had become charred or burned by the heat of the pipe, thus giving vent to the steam, and alarm to the fireman. The furnace was cleared, the defected joint repaired, water supplied, and the engine in operation again in ten minutes.

In addition to the usual guage cocks, and for greater safety, there is attached to this boiler a float with a lever, intended to operate in the mode described in your Journal for July, of an improvement by Mr. Potts with this difference, that it was arranged to regulate a *waste* cock, by which surplus water should be returned to the hot cistern. This has not been completed, because it is found that the float is so much agitated, probably by the ebullition from the pipes; that it is considered rather unsafe to rely upon it. For economy of fuel, I consider this boiler equal to any I have known in use; it occupies less ground, and the reports of the performance of Woolfe's engines, at the Cornwall mines, and the long time they have been used, seem good proof of their safety, utility and economy.

Respectfully yours,

D. J. BURR.

Richmond, Va. October 9, 1830.

AMERICAN PATENTS.

Specification of a patent for a Rotary Pump, to be used for the raising or forcing of water and other liquids. Granted to Ebenezer R. Hale and Charles Lazareme Bell, of Hyde Park, Dutchess County, New York, July 14, 1830.

Two wheels are constructed, one of them having, on its periphery, floats or wings, three in number, (more or less) at equal distances apart, and something in the form of cogs; the other said wheel having a cavity, or cavities, (depending upon its size) in its periphery, into which cavity or cavities may fall the wings or floats of the wheel aforementioned, they being placed in a manner to revolve together, and when so placed,

their peripheries are intended to come in close contact, so as to form a water joint.

The above described floats are an inch and a half in length, and three in breadth, (more or less,) or the thickness of the wheel or hub, on which they are; which thickness, as well as the length of the floats, should be in proportion to the diameter of the wheel on which they are, and the quantity of water, &c. they are intended to raise or force.

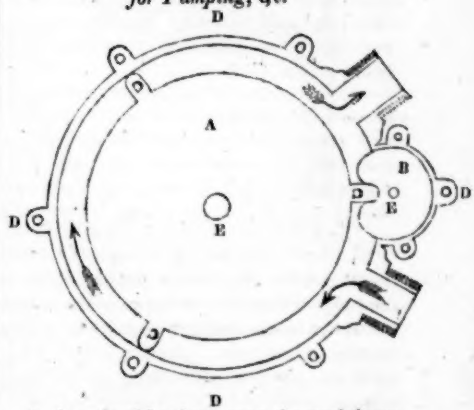
The two above described wheels are enclosed in a casing corresponding with the size of the wheels, which casing fits closely upon the sides of the wheels, and upon the periphery of the one having the cavity or cavities as aforesaid, and equally close on the outer extremity of each wing, or float, in each and every part forming water joints, to effect which it may be packed with leather, or other suitable material, in such places as may be found necessary. Through the ends, or heads, of the above described casing, pass the shafts which support the two wheels before specified, on, and with which they are made to revolve.

The gudgeon boxes are made in such a manner as to admit of packing, which packing generally consists of cork. Upon the shafts just mentioned, and on the ends which project through the end, or head of the casing, are toothed wheels; they are of such size as will cause the wheels within the casing to revolve in such a manner as to bring the floats of the one into the cavity or cavities, of the other, which said fronts are fitted, or packed, so as to form a water joint while revolving and within the cavity or cavities of the wheel aforementioned. To the casing which contains the wheels, and on or near to the periphery of the same, are two passages or apertures, to each of which a pipe may be attached, one for the supply, and the other for the discharge of water, &c.; the passages to which are the pipes, enter the casing as near as is convenient to the wheel within, having in it the cavity or cavities aforesaid, one of them being upon each side of the same; or the place for the discharge may be varied, provided it be placed from the supply passage a distance not less than the space between two floats or wings. The pump may be put in motion by hand or other power; the water, &c. is drawn in by suction, produced by the motion of the floats as they recede from the wheel in which is the cavity or cavities: it is discharged in like manner by their motion as they approach the discharge passage. This pump is subject to variations: it may have two places for supply, and two for the discharge: this may be done by placing another wheel having in it a cavity or cavities similar to the one above specified, on the opposite side of the wheel upon which are the floats, and gearing it with that wheel in such a manner as to give to it the necessary motion for bringing the wings, or floats, of the one, into the cavity or cavities of the other. The above specified floats, or wings, may be attached to the wheel by forming a notch, or mortise, in the wheel from the periphery, in a line to the centre, of the same thickness of the float, and one inch in length, more or less, in this notch, or mortise, is placed one end of the float, leaving the other end projecting a suitable distance from the periphery of the wheel. A *screw and nut*, or a *wedge*, or *spring*, is also fixed in the bottom of the said mortise, or notch, for throwing the wings, or floats, out from the wheel, as occasion may require, for the purpose of keeping a close joint between them and the casing.

That which we claim as our invention and improvement, is, having the floats which project from the periphery of the wheel, and which act as buckets, *stationary*. And also the application of the revolving block, or wheel, in which is the cavity or cavities to the rotary pump; the placing and revolving these wheels together, as above specified, for the above mentioned purposes.

EBENEZER R. HALE.
CHARLES LAZAREME BELL.

Section of Hale and Bell's Rotary Engine for Pumping, &c.



A, the wheel having upon its periphery, floats or wings.

B, small wheel, having in it a cavity or cavities to receive the floats.

C, C, C, the floats, wings, or fans.

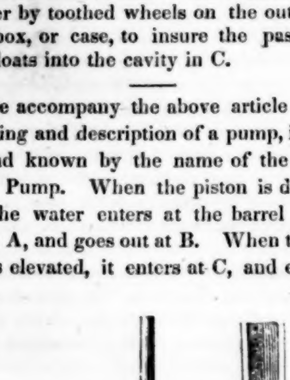
D, D, D, the casing which encloses the wheels.

E, E, the shafts or axles.

The passages for the supply and discharge of water, are shown by the bent arrows.

The axes of A and B are connected together by toothed wheels on the outside of the box, or case, to insure the passing of the floats into the cavity in C.

We accompany the above article with a drawing and description of a pump, invented and known by the name of the De la Hire Pump. When the piston is depressed, the water enters at the barrel of the valve A, and goes out at B. When the piston is elevated, it enters at C, and escapes at D.



This pump partakes of the nature of a forcing and a sucking pump; the same piston is made to serve a double purpose, the rod working in a collar of leather, and the water being admitted and expelled in a similar manner, above and below the piston, by means of a double apparatus of valves and pipes.

In the London Mechanicks Magazine for June, there is an improvement on this pump, suggested. An air chamber is placed on the discharge pipe, just above D; as the water is forced by the piston into this chamber, the elasticity of the confined air, acting as a spring, discharges the water in a steady stream, through the upward tube. From the advantages this pump possesses, and particularly when worked by steam, we are surprised it is not more generally in use. "It produces the effect of two pumps with the friction of one"!

"Extraordinary advantages have always been expected from the introduction of *rotary pumps*; *theory* gives them a trifling superiority, but I very much doubt if in *practice* they will ever equal, much less surpass, the double acting pump of M. de la Hire."

For a new and useful improvement in Flouring Mills; Jonathan Thompson, Ashtabula, Ashtabula County, Ohio, July 7, 1830.

This "Flouring Mill," adds another to the list of those grist mills which are sufficiently small to be portable, and in which stones of a very diminutive size are to be employed. The patentee proposes to give motion to both stones, but to move them with different velocities. The spindle of the lower stone is to be a tube, from which arms project out at right angles for the purpose of attaching the stone to it. The lower end of this tube rests upon a step, within which it runs; this step is perforated, to allow the spindle of the upper stone to pass through it, and through the tabular shaft or spindle of the lower stone. Upon each of these spindles is a whirl, each of which may be turned by a strap from a drum, such an arrangement being made as shall reverse their motions.

The straps are to be kept of a uniform tightness by means of tightening pulleys, which are borne up against them by a weighted lever.

The upper stone is to be pressed down by weights, as, in small light stones of the description intended to be used, the gravity of the stone itself would be inadequate to the effect which it is intended to produce. This pressure is to be made by means of a transverse beam, in the middle of which, on its lower side, is a metal box, to receive the end of the spindle of the upper stone. The ends of the transverse beam slide in mortises, to allow of its elevation or depression. It is drawn down upon the stone by weighted levers at each end, acting upon

it through the medium of cords, or chains attached on its lower side.

The advantages said to arise from moving both stones, with different velocities, "are to increase the motion, and facilitate the grinding, and to prevent entirely the possibility of the clogging of the stones by the dampness of the grain, or from other causes. Both stones being in motion, no particle of grain can remain stationary and impede the progress of others, but all are hurried to the circumference with exceeding briskness."

The manner of loading is considered as superior to any other; and the tightening of the straps by means of pulleys, is also mentioned as a very advantageous arrangement.

There is no *direct* claim to any part, and were we to *infer* what is meant to be claimed, it is the running of both stones with different velocities, the manner of loading the upper stone, and the mode of tightening the straps.

The running of both stones has been patented more than once, and we see nothing in the "different velocities" which offers any advantage over the moving them with the same velocities.

The arrangement for pressing down the upper stone is undoubtedly good, but this may be readily done, and, indeed has been done, by other means producing the same effect. If the particular method described is superior to those which have preceded it, this certainly must be deemed an improvement.

With respect to the pulleys for tightening the bands, however good they may be, they have no claim to novelty, and a patent based upon the use of them, could not be sustained.

We have given more space to the description of this apparatus than we usually spare for such a purpose; our reason for so doing is, that a small efficient grist mill, afforded at a moderate price, and driven by a power within the command of every farmer, is a desideratum; and we wish to point out to patentees the necessity of designating particularly what is really new in their machines, of claiming this distinctly, and of carefully avoiding to claim too much.

For an improvement in the Mode of Making and Manufacturing of Crackers, Ship, Pilot, or Navy Bread, or Buiscuit, by means of which one or more may be cut, pressed, dotted, stamped, and finished, by and at the same operation; being a rectangular machine, and called the "Franklin Cracker Machine;" Nathan Daskam and David G. Wood, Geneva, Ontario County, New-York, August 5, 1830.

We are informed in the specification that "this improvement in the making and manufacturing of crackers saves manual labour, and enables two persons to make as many in one day as ten men can in the same length of time by the common operation, and the crackers are of a superior quality, and uniform as to appearance."

The specification consists entirely of references to the drawings which accompany it. There is no claim made; the whole machine, therefore, must be new, or the patent will not stand the test in a court of law.

The dough is placed upon a table which is carried backward and forward between rollers; on the bottom part of the frame there are dockers, which dock, cut, and stamp the cracker.

Without a plate of the machinery the operation of it could not be clearly described.

For a Machine for Cutting Biscuit, Crackers, Cakes, Pilot and Navy Bread; Joseph Clark and Henry Henderson, Baltimore, Maryland, September 13, 1830.

The dough to be made into biscuits is put into a hopper, whence it is delivered between two rollers; these roll it to the proper thickness, and spread it upon a sliding board; this board is made to advance with the proper degree of speed. From a whirl, attached to one of the rollers, a band extends to the opposite end of the bench or frame, in which the sliding board works, and is made to turn a crank shaft; a pitman or connecting rod, passes up from the crank, to one end of a lever working like a scale beam. At the opposite end of this lever, is a rod, which is worked up and down by the vibrations of the lever; and on the lower end of the rod is screwed the cutter and prickers, cast in one piece, and of the size and form desired.

The sliding board is made to advance by means of notches along its side in the manner of a rack, into which a catch, or feed arm works, this feed arm being operated upon by the same crank, which causes the lever to vibrate. The advance at each thrust of the feed arm, is equal to the diameter of the biscuit to be cut.

The claim is to the "machine for cutting biscuit, crackers, pilot and navy bread, &c.

as before described, except the rollers and hopper, and the form of the cutters; but we claim the mode of casting the cutters, prickers, and plate of metal, in one piece."

We think this claim both indefinite and insecure; indefinite in claiming the machine "as before described;" and insecure in afterwards apparently limiting it to the cutter, &c. "in one piece," as the cutters, &c. may very readily be made in several pieces, and securely joined together. The casting in one piece may be the cheapest mode, we much doubt its being the best.

Note.—There were but seven patents issued in the month of August; and in September, but one. This was in consequence of the absence of the President from the seat of government, his signature being necessary to the validity of a patent.—(Franklin Institute.)

ENGLISH PATENTS.

To Thomas Bulkeley, Doctor of Medicine, for a method of making or manufacturing Candles. Dated January 6, 1830.

This invention is stated to consist, first, in a method of making wax candles by melting the material and pouring it into moulds, instead of by the ordinary method of rolling. The moulds are to be the same as those employed in the manufacture of tallow candles, but as there is a difficulty attending the expulsion of the candles when cold, a circular piece of wood with a cavity in its centre is directed to be placed at the bottom of the mould, when the other end being gently tapped by a mallet, the candle will, by degrees, be driven out. And here we may remark that the patentee appears to have adopted every means in his power to guard against any charge of obscurity in the framing of his specification, having even had the foresight to furnish us with a full sized representation of a *mallet.*

The second improvement is in forming around candles a coating of wax, or other composition, which requires a higher degree of temperature to melt it than the substance of which the interior is formed; by which means it is affirmed that a cheap candle is obtained, having the appearance of wax or composition, in which the liability to gutter is prevented.

The mode in which Dr. Bulkeley proposes to manufacture these candles is by pouring the wax or composition intended to form the coating, when in a fluid state from heat, into common metal moulds; and after allowing it to remain such a time as will admit of the congealing of a portion, the remainder of the wax, which will be that in the centre of the candle, is then poured off, and tallow substituted in its stead. The patentee observes, that an excellent candle may be produced by filling the casing with oil, in lieu of tallow; but in this instance it will not admit of being moved from place to place when in use.

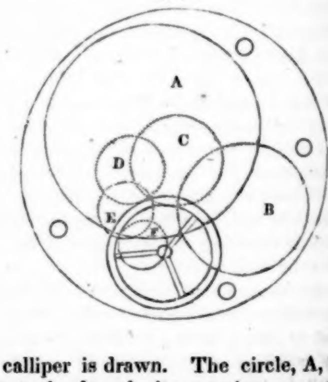
The third claim in this patent is for an improved wick, by which, it is stated, a great saving will be effected in the material usually employed for that purpose. It is formed of a thin cord or thread passed through the centre of the candle, and through a small piece of straw about half an inch in length, around which is attached some common cotton wick of a similar size; the thread will be consumed as the wick burns, and the latter will slide down and prevent the necessity of snuffing.—(Rep. Pat. Inven.)

To Robert Westwood, Watchmaker, for certain improvements in Watches and Timekeepers. Dated September 23, 1829.

I, the said Robert Westwood, do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, is described and ascertained in the annexed diagrams, and the following explanations thereof. As the individual parts composing a watch movement are already well known and in use, I shall only describe the manner in which they are arranged and combined in my patent watches and timekeepers, which is as follows, (that is to say:—)

The frame consists of two circular plates, united by pillars, in the usual manner. Fig. 1, represents the pillar plate on which

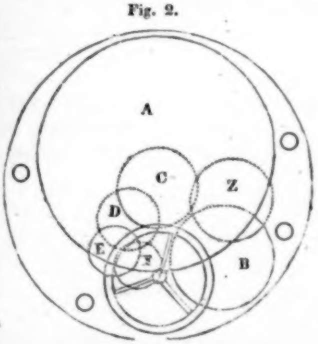
Fig. 1.



the calliper is drawn. The circle, A, represents the barrel; it occupies more than

two-thirds of the diameter of the frame and the usual height between the plates, and is usually termed a going barrel, having teeth on its edge, and constituting the first or great wheel. The circles C, D, and E, represent three wheels and pinions, usually denominated, in thirty hour movements, the centre, the third, and the fourth, from which they do not differ, as far as regards their uses: and the circle, F, represents the escapement wheel and pinion. These wheels and pinions are placed under the barrel, that is to say, between it and the dial plate, in cavities formed in the pillar plate, with cocks or bars to receive their pivots, the space between them and the upper plate being occupied by the barrel. The motion is communicated from the barrel to the wheels under it by means of an intervening wheel and pinion, represented by the circle, B. The teeth on the edge of the barrel act in the pinion B; and the wheel B, which is sunk, acts in the centre pinion. By referring to the diagram, Fig. 1, it will be seen that the diameter of the wheel B extends from its proper depth in the centre pinion to the edge of the plate: and as it cannot be placed at a greater distance from the centre of the barrel, it therefore limits the size of the barrel; but by introducing an additional wheel to communicate the motion from the wheel B to the centre wheel, there will be room for a barrel of still larger dimensions. Fig. 2,

Fig. 2.



represents a calliper of a movement with the additional wheel, and a barrel of more than three-fourths of the diameter of the frame; the wheel B, (which is smaller in diameter than in Fig. 1, (acts in the pinion of the additional wheel, represented by the circle Z; and the wheel Z acts in the teeth of the centre wheel, which has no pinion, only a plain arbor. The additional wheel being under the barrel, is sunk, with its pinions in the same manner as the centre, third, and fourth, before described. The relative velocities of the centre wheel and barrel are the same in both callipers, namely, sixty-four to one. The ratios of the intermediate wheels and pinions may be varied without any material consequence. The upper plate receives the pivots of the barrel, arbor, and the pinion B, in both callipers, in the usual manner; and it also bears the jewelled cock in which the balance pivot acts. The points upon which I ground my right of exclusive privilege to the above invention and improvements under my aforesaid recited patent, are, the arrangement of the wheels and pinions, as far as regards their being placed so as to act under the barrel, that is to say between it and the dial plate as before described and shown in the annexed diagrams, thereby admitting within the limits of a pocket watch of the usual size, a maintaining power of sufficient strength, with one winding up, to keep up a vigorous motion in the balance for the space of eight days, or for a longer period if required.

Observations by the Patentee.—The above invention is applicable to all horological machines, wherein a strong maintaining power is required within a small compass; and is suited particularly to pocket watches, in order that they may require winding up only once a week.

The failure of all former attempts to make eight day watches, has been chiefly attributable to a deficiency in the maintaining power; but this defect is completely obviated by the above invention; so much so, indeed, that the eight day watches, on this construction, will be found to perform as well as the best thirty hour watches, while they have the additional advantage of not requiring the daily attention of the wearer to wind them up.—(Ib.)

IMPORTANT INVENTION.

Mr. Lemuel Langley, Master Joiner of the Gosport Navy Yard, has constructed a model of a *Ventilator*, of his own invention, which it is not extravagant to say is destined to save millions to the Government in the preservation of ships of war from the *dry rot*, as well as to stop the waste of valuable lives by diseases engendered from the foul air confined in the interstices of the timbers of those ships while exposed to a tropical climate. We have not examined the model, but rest our sanguine anticipations of its success in accomplishing these

important objects on the unequivocal testimony of experienced and scientifick navy officers, who examined it yesterday on its first exhibition by the inventor. The rapid decay of our vessels of war, beyond that which attaches to merchant ships, is well known to be caused by their different constructions: the former having their timbers necessarily of extra size, and so closely laid together, for strength, as to prevent a circulation of air, which in its confined state becomes immediately deleterious to perishable substances, and causes what is familiarly called the *dry rot*, in the ships' timbers, requiring frequent and expensive repairs; while the latter, being more slightly constructed, a circulation of air is admitted between the timbers, and they are thus, to a degree, secured from premature decomposition. Much sickness, too, is produced on board of ships of war cruising in tropical climates, by the foul air escaping from its confinement between the timbers.

The removal of this frightful evil, this silent but malignant foe to our navy, is confidently asserted to be within the power of Mr. Langley's Ventilator; and if so, Mr. Langley will deserve the thanks of the nation, independently of the pecuniary reward to which so signal a publick service will justly entitle him. We shall forbear to say more upon the subject at present. The model will be transmitted to Washington by the earliest opportunity, with a view to obtaining a patent for it, when we shall hear the opinions of the eminent men at the head of the navy, respecting it.—(Norfolk Herald.)

What this important invention *is* we do not learn from the above account, but from the repeated inventions of this nature, we are inclined to doubt its efficacy, at least to such a degree as supposed in the above paragraph. We are fearful, however, it is nothing more than what has been tried an hundred times before, the difference each time, being only its diversity of form. At p. 234, of our work, the reader will find a method described for ventilating ships, and (according to the article annexed) of preventing Dry Rot.

"There are no means of restoring rotten timber to a sound state, and the dry-rot can only be *cured*, as it is called, by removing the decayed and affected parts, clearing away all the fungi, and destroying its vegitating principle, with which the hard materials, such as bricks or stone, may have been impregnated. For this purpose, a strong solution of iron, copper, or zinc, is used with advantage. This, with the admission of a large quantity of air, is very advantageous. Many persons have written on the subject; and the nostrums proposed are as numerous as their authors. But no means of checking the evil can be depended upon, except that of removing the corrupted and contagious matter, and admitting a free circulation of air. Much also may be done by cutting timber in winter, and properly seasoning it, by steeping it in water for some time, and then thoroughly drying it before it is used in building."

To John George, of Chancery Lane, in the Co. of Middlesex, Esq. Barrister at Law, for his having found out, or discovered an invention for preserving decked ships or vessels, so as to render them less liable to dry rot; and for preserving goods on board wet ships or vessels from damage by heat.

It is considered by the patentee that the general causes of dry rot arises from the timbers being exposed to different degrees of temperature, acting upon different parts of their surfaces at the same time; his object, therefore, is to effect a more perfect ventilation than the present construction of vessels will admit of. It is assumed that the confined heat within the vessel makes its escape into the colder medium through the solid timbers, and other wood work, and in so doing produces the approximate, if not the immediate cause of decay; to prevent this, the patentee proposes to place a perpendicular hollow shaft from the lower part of the hull up to the deck through which cold air is to be passed, and collateral tubes are to be branched off from this main tube, extending to different parts of the vessel, with orifices in them, furnished with valves for the discharge of the air. Apertures are to be formed in different parts of the vessel, to receive the cold air, and tubes with valves made to extend therefrom, for the purpose of carrying off the hot air. The hot air is to be expelled from the different parts of the vessel by the superior pressure of the cold air, passed down the perpendicular shaft: the exit apertures to be closed by very light valves.

The Editor of the London Journal of Arts and Sciences, (in his remarks on the

above patent,) regrets that he is unable to discover any originality of invention in this mode of ventilating, or ingenuity of contrivance in adapting it. He also says the Patentee has invented, and brought into fair parchment, no less than an *hundred and ten* Chancery folios of written description, philosophical discussion, and legal comment, bearing upon this subject!

COMMUNICATION.] [FOR THE MAGAZINE.

MR. EDITOR,—Looking over some papers of a recent date, my attention was attracted by an article in one of them on an IMPROVED CHURN! (secured of course by a *patent.*) Now sir, you must know, that occasionally I take a peep at the list of patents which so frequently emenate from our patent office, and as the article of churns occurred pretty often, I had the curiosity to count the number of patents granted for this machine, in which I included the improvements, since the opening of said office; and the result was, that about 90 patents had been obtained from the year 1790 to 1828; a fair inference may follow, that up to this time, the number considerably exceeds ONE HUNDRED! Think of this, sir. One hundred churns *invented* and patented, in the short space of forty years. Now, I would ask whether these inventions, or improvements, in order to make their letters-patent valid, should not differ materially from each other, and not in construction merely, but in principle?*

The answer is obvious,—we know that they should, and it is almost equally obvious, that such has not been the case. No one, I presume, will for a moment suppose that these inventions (and for so simple a machine) could all differ from each other, and all have equal claims to utility. The fact then is that the patentees have only been playing the *plagiarist* upon each other. (A few instances, perhaps, to be exceptions, for two or more individuals may possibly have conceived and brought into action machines perfectly similar.)

Here, Mr. Editor, I leave the churn, if you please, and apply my remarks to inventions in general.

If then, most of the inventions which find their way to the Patent Office are no more than modification upon modification, they are not *important* as *improvements*, but *important* as *evils*, both to the projector and the purchaser: causing an useless expenditure to both. A remedy might, I think, be found, a remedy in part, at least; and to this end I would propose that our mechanicks, and indeed all who wish to know what is "going on in the world," supply themselves with scientifick books, and with a Journal or two of the present times—such as pick up all the new inventions as they come along—and from these learn what has been invented, and what has been abandoned as useless; this would save many a poor fellow the expense of a drawing of his invention, a specification, and, lastly, letters-patent; to say nothing about the cudgelling of brains in bringing to form an invention—an invention, which, ten chances to one, had before been tried and, perhaps, abandoned by some one before him. A few dollars expended in this way, would save hundreds, not to the mechanick, only, but to the purchaser; as from this source, both might have been informed of its true value.

The following is the article at first alluded to. I think the machine described posses some merit, but I very much doubt that the present is its first appearance. I recollect of seeing, in London, a similar contrivance, in some of the breweries. This, to be sure, does not affect the ingenuity of the inventor, (provided it be new with him,) but it might have saved him time and labour, had he known how to construct it off hand; which knowledge, in all probability, could have been obtained in the manner I have suggested.

"IMPROVED CHURN.

We have examined, at the shop of Mr. William Sutton, of this village, a Churn lately invented by him, which he styles the "*Geneva Double Dasher Churn*," and for which he has obtained a patent-right. The tub is similar in construction to the kind in common use, and may be made of any size. There are two upright dashers, which are turned, the one forward and the other backward, by means of a vertical wheel, with a crank and handle, the cogs of the wheel mashing into a trundle head at the top of each dasher. To the shafts of each dasher are affixed horizontal paddles or wings, which move through each other, and, by their *contrary* motion, agitate the cream and produce the butter. The operation is so easy, that a child of eight or ten years of

* The law requires "that the discovery or invention should be new, not known or used before."

age will perform the work, in far less time, that would require the strength of a man in the ordinary method.—Usually but eight or ten minutes are required for a churning. The machinery may readily be attached to a churn of any construction.

The inventor contemplates adding some simple machinery, or clock-work, with a cord and weight appended, which being wound up, will turn the wheel and perform the churning without further manual labour.

We would recommend to our farmers and dairy-men, and indeed all interested in so important an improvement, to call at Mr. Sutton's shop and examine his invention. So far as we can judge of its utility, we have no hesitation in saying, that it is a most valuable accession to the labour-saving machinery of the country, and that the enterprising proprietor most richly deserves the liberal patronage of the community.—(Geneva Gazette.)"

—ALSO—

"*A Patent granted to Moses Granger, (Syracuse, Onondaga County, N. York, for an Improved Churn.*

In this churn there are two vertical shafts, each carrying dashers, and both turned by means of a crank and cog-wheel above, in a way which we have more than once described. No claim is made to this part, the improvement consisting of a partition, crossing the middle of the churn to prevent the cream from acquiring a rotary motion. This partition is notched to allow the dashers, or wings, to pass.—(Franklin Institute.)"

This last *invention* appears to be nothing more than a modification of Mr. Sutton's churn. But, as I have already occupied more room in your Magazine than I at first intended, I shall merely remark that I cannot conceive how the cream will acquire a rotary motion, as one shaft, with its dashers, turns from *east* to *west*, while the other turns in a contrary direction. It must require something more than mathematical skill, to determine why the cream should rotate in one direction in preference to the other; they must necessarily destroy each others effect in producing such a motion.*

On reading the first account, it occurred to me that probably there was a difference in the specifick gravity of the butter-milk and the butter while separating from each other—that the butter would either have a tendency to rise or fall. If such be the fact, setting the dashers a little oblique—so that the lower edge might travel a little forward of the upper—would effectually raise the butter from the bottom. If the machine was turned the other way the tendency would be to depress the butter.

The clock-work, spoken of by Mr. Sutton, to drive the machinery of his churn, would be a disadvantage. A piece of clock-work, made durable, and capable of doing the work of a child of ten years of age, and for ten minutes, from once winding up, would be a costly thing; besides, instead of saving time and labour, there would be a loss of both, for while any person was winding up the weight the churn might have been at work.—And, after all, the weight will not exert as much force on the churn as was required to raise it up.

Mechanicks frequently commit errors like this. A pump was contrived in this city about a year ago, which was said in the newspapers to be important to ship-owners. It consisted of machinery for raising a heavy weight, which was to work the pump as it was going down; here was a loss of power, for the men might have pumped more water while the weight was raising, than could be done by its descent. A plea was set up that the weight could be raised during a *calm*, but this would be like saving one ear of corn against a time of famine.

A Friend to Real Improvement.

* From our small stock of knowledge in matters of this kind, we believe our correspondent is a little out here. From this hint he will please look at the thing again.—Ed.]

Friction.—If an horizontal plane were perfectly smooth, a body might move upon it with the utmost ease in any direction by the least force applied to it. But however smooth and even bodies may appear to the eye, if their surfaces be examined with a magnifying glass, inequalities will be discovered, and the prominent parts of any one body, when moving on another, will fall in the depressed parts of each other, so that the two bodies become in a manner locked together; therefore, in moving them over each other, one of the bodies must be raised up or its prominence broken off—this is termed friction.

Friction is, in some measure, in proportion to the weight of bodies or pressure against each other. It does not increase in proportion to the surface, though it may in

some measure increase in proportion to the velocity.

When the polished steel moves on the same, or on pewter, properly oiled, the friction is about one-fourth the weight; on copper or lead, one-fifth the weight; on brass, one-sixth. Metals have the most friction when they move on metals of the same kind. The least friction is generated when polished iron moves on brass or a composition in certain proportions of copper and spelter; gudgeons and pivots of wheels, and the axles of friction rollers, should be made of polished iron in preference to steel.

The most proper unguent to prevent friction is lard or tallow, when the surfaces are of wood; and oil, when they are made of metal. When the forces with which the surfaces are pressed together are very great, tallow will diminish the friction more than lard. The best method of applying the unguent, is to cover the rubbing surfaces with as thin a stratum as possible, in order to make the friction uniform. In small works of wood, the interposition of the powder of black lead is found very useful. The friction of a single lever is very small, that of the wheel and axle in proportion to the weight, velocity, and diameter of the axis. That of pulleys is very great, on account of the smallness of their diameters in proportion to their axis, their bearing against their block, and from the wearing of their holes and axis.

The friction is very great in the wedge and screw. Screws with sharp threads have more friction than those with square ones—and endless screws more friction than either.—(Tech. Repository.)

(From the Franklin Journal.)

Note from Professor Hare, to Mr. J. P. Morris, relative to an explosion which occurred in the Pipe and Drum of a Stove.

September 28th, 1830.

Sir,—During the last winter, when I was too much engaged in the preparation of the experimental illustrations required by my lectures to withdraw my attention, you requested that I would explain the cause of an explosion which occurred in the pipe and drum of an anthracite stove. I believe the circumstances were as follows.—The fire having nearly burned down, but not being quite extinct, a considerable quantity of old paper was thrown into the stove. An explosion soon after ensued, by which the drum was ruptured, and other derangement produced.

The rationale I conceive to be as follows: By the heat of the fire which remained in the stove, carburetted hydrogen was evolved from the paper, but happened not to be inflamed until sufficient quantity had been generated to form with the atmospherick air in the drum and stove pipe, an explosive mixture. An analogous result upon a more limited scale may be frequently observed when paper or shavings are thrown upon a fire where there is no flame so situated as immediately to ignite the gas evolved. If a piece of paper had been lighted beforehand, and thrown in on the top of the mass, the explosion had been prevented.

Sir, your obedient servant,

Robert Hare.

AIR-GUN.

The most wonderful effect of condensed air is exhibited by the air-gun. This instrument differs from a common gun, in having a receptacle for air, which may either be a hollow ball screwed to the lower end of the barrel at its under part, or a cavity in the breech. These chambers, when opened, communicate with the barrel, and when the condensed air is suffered to escape, it rushes into the barrel and drives out the ball with surprising velocity.

It is a curious fact, that, although the air-pump is comparatively a modern invention, the air-gun, so nearly allied to it in the construction of its valves, should have existed long antecedent to it. For it is recorded that an air-gun was made for Henry IV. by Marin, of Lisieux, in Normandy, in 1408; and another was preserved in the armory of Schmetau, bearing date 1474.—That in present use is, however, very different in effect from those originally made, which discharged but one bullet after a tedious process of condensation. While the present one may be made to discharge thirty or forty with effect, with the same charge of air.

The air-chamber is charged by screwing it to the end of the condenser, and forcing it down suddenly upon the piston, which is securely held by the feet resting on its handle. The air resting on the piston, is thus forced into the chamber through the opening, which is covered by a valve opening inwards. At each depression of the chamber upon the piston, the air is driven upwards, whence it cannot return on account of the valve.

When sufficient air has been condensed this chamber is to be removed and attached to the gun, which is then ready to receive the ball. This is placed in the mouth of the barrel, and is made to fit closely by first laying it on a small piece of linen, which, when forced down by the rod, perfectly fills the bore.

In discharging the gun, the force of the lock is directed by a small steel piston, moving through a collar, against the valve of the chamber. The air instantly escapes by its side, and rushing into the barrel, drives out the ball. It is necessary to observe, that the action of the lock being instantaneous, the power of the piston is lost after its projection, and it immediately recedes, while the elasticity of the air forces the valve to its place, thereby preventing the escape of more than was intended. The discharges may be continued until the resistance of the condensed air is reduced to its ordinary pressure.

There were two other applications of this principle, recently exhibited in this city, in the model of a cannon and in a common walking-cane, the workmanship of Mr. Adam Stewart, an accomplished mechanician. The improvements in his use of the principle, evince great skill and ingenuity in their projector.

The estimates of force possessed by the air-gun, when fully charged, have been very various. Even in its earliest days there existed wonderful stories of its power.

By many, the expansive force of the air in the chamber, has been compared with that of gun-powder. But the only opinions worthy of attention are those founded on experiment. The smallest result of the force of gun-powder, that we have met with, is that given by Mr. Robins. His calculation was, that the elastick force of the fluid produced by ignited gun-powder, is at least one thousand times greater than the ordinary pressure of the air. And if we consider that pressure to be fifteen pounds to the square inch, we have a result of fifteen thousand pounds to every square inch of the surface which confines it.

The ordinary charge of air-guns, has been equal to between forty and fifty atmospheres, or between six hundred and seven hundred and fifty pounds to the square inch. But in the instruments of Mr. Stewart, this pressure has been very much exceeded. And we believe he has produced greater condensation in the chamber than any who has preceded him.

The experiments of Bernoulli and Count Rumford, resulted in their belief that the force of ignited powder was at least ten thousand times greater than that of the ordinary pressure of the atmosphere.

According to the smallest calculation, we perceive before these forces can be equal, a pressure of at least fifteen thousand pounds to the square inch must be produced by compressed air.

ARTIFICIAL PEARLS.

These are small globules, or pear shaped bulbs, blown in thin glass, and each pierced with two opposite holes, by which it may be strung. These are afterwards prepared in such a manner as to greatly imitate the rounded and brilliant concretions, reflecting the irridiscent colours which are found in certain bivalve shells, such as the pearl muscle, &c., and which bear the name of oriental pearls.

We can perfectly imitate the brilliancy and reflection of these natural pearls, by means of a liquid, termed essence of pearl, and which is prepared by throwing into liquid ammonia the brilliant particles which are separated by friction and washing from the scales of a small river fish, named the bleak.

These pearly particles, thus suspended in the ammonia, can be applied to the whole interior of these glass bulbs, by blowing it into them; after which, the ammonia is volatilized by gently heating them.

It is said that some manufacturers do not employ the ammonia; but instead thereof, suspend the pearly particles in a solution of isinglass, well clarified, and which they drop into the bulbs, and then turn them in all directions, in order to spread it equally over their interior surfaces. There can be no doubt, that in this mode of applying the pearly mixture, the same success will be obtained as in the before mentioned process, and that it will afford a layer of the same thinness and brilliancy.

It is important, to succeed in the perfect imitation of pearls, that the glass bulbs or pears employed should be of a slight bluish tint, opalized, and be also very thin, and likewise that the glass should contain but little potash, or oxide of lead. In each manufactory of these artificial pearls, there are workmen exclusively employed in the blowing of these glass bulbs, and which indeed requires a great skill and dexterity to succeed well therein; a dexterity, indeed, which can only be acquired by long practice.

The French manufacturers of these artificial pearls have at length attained a degree of perfection before unknown. We must add, that the bulbs are finally filled up with white wax.—(Dict. Technologique.)

Damage of the Delaware Division of the Pennsylvania Canal.

Along the upper section of the Delaware Division of the Pennsylvania canal, there are now from 200 to 300 hands at work repairing damages &c. and it is expected that in a few weeks the water will be again tried in the canal; but with what success, we suspect, is problematical. In the first ten miles the canal passes numerous beds and bluffs of limestone, and where the bottom is treacherous. In many places the material for making the embankments was not very good, and in others, the best that could be obtained was not used. The canal, when in operation, will be perhaps the most productive one in the State, but by the time it will be so, it will have cost $20,000 per mile.—The one fourth of that sum expended on the river, we think would have made at least as good a navigation, with a tow-path on shore, the whole distance to Trenton.—(Eastern Whig.)

Navigation of the Connecticut.—We learn from the Springfield Republican, that this river is to be prepared for steam navigation to the extent of 300 miles from its mouth, and that measures are in train to insure the building of a number of boats, to operate as soon as possible, the next season, for which purpose the subscription books for the stock are circulated through the valley.

Railways.—The interest of rail-roads appears to be advancing. We give below an extract of a letter from a gentleman at Liverpool, England, dated October 19, 1830:—

"Our railway to Manchester, (30 miles) has now been in operation for one month, the receipts for passengers only, they being not yet ready for the conveyance of goods, amounts to 8000 pounds sterling!"

That is a good month's work for passengers alone. 35,552 dollars in thirty days, more than 1180 dollars per day.—(Mauch Chunk Courier.)

Unparalleled Steam Engine Trip.—Mr. Stephenson, the proprietor of the Rocket Engine, on the Manchester and Liverpool Railway, had this week decided in his favor a wager of one thousand guineas upon the speed of his Engine, by traversing the distance between the two towns, (thirty-two miles) in thirty-three minutes, or in other words, at more than 58 miles per hour.

Cheap and valuable Manure.—Raise a a platform of earth, eight feet wide, one foot high, and of any length, according to the quantity wanted, on the head land of a field. On the first stratum of earth lay a thin stratum of lime, fresh from the kiln; dissolve or slack this with salt brine or sea water, from the nose of a watering pot; add immediately another layer of earth, then lime and brine as before, carrying it to any convenient height. In a week it should be turned over, carefully broken, and mixed, so that the mass may be thoroughly incorporated. This compost has been used in Ireland, has doubled the crops of potatoes and cabbages, and is said to be far superior to stable dung.—(London Magazine.)

Muscular Strength.—The muscular power of the human body is wonderful. A Turkish porter will run along carrying a weight of 600lbs.; and Milo, of Croton, is said to have lifted an ox weighing 1000lbs. Haller mentions that he saw an instance of a man whose finger being caught in a chain at the bottom of a mine, by keeping it forcibly bent, supported by that means the weight of his whole body, (150lbs.) till he was drawn up to the surface, a height of 600 feet. Augustus II, king of Poland, could, with his fingers, roll up a silver dish like a paper, and twist the strongest horse-shoe asunder; and a lion is said (Phil. Trans. No. 310.) to have left the impression of his teeth upon a piece of solid iron. The most prodigious power of the muscles is exhibited by fish. A whale moves with velocity through the dense medium of water, that would carry him, if he continued at the same rate, round the world in little more than a fortnight; and a sword fish has been known to strike his weapon through the oak plank of a ship.

Something new for the Antiquarian.—A few weeks since, George Dixon, of Seneca, commenced digging a well about three miles from the village of Geneva, near what is called the Potterstown road, and about 80 rods from a small creek—the ground is nearly 100 feet higher than said creek. After digging through the soil to the depth of 33 feet, he came to a hard blue clay, which continued 10 feet further, and then he struck upon a vein of coarse black sand, mixed with snail shells, which was about 3 feet deep. In this sand he discovered a piece of wood 8 inches long, and 6 inches in circumference at the smallest end. This was at the depth of 46 feet from the surface. For 14 feet further the strata was sand mixed with moss coal, and some appearances of rotten brush, and the bark of trees. The well is

now dug below 70 feet, and is perfectly dry, except what water leaches in above the strata of sand. The soil is now a very fine sand or loam, with now and then a strata of slate, irregularly jumbled together with every appearance of its having been thrown there by water. What renders this more remarkable is, that the ground, to the depth of 43 feet, is firm and solid, without the least appearance of having moved since the creation.—(Ontario Phœnix.)

Singular Discovery.—Mr. Horton, a gentleman who has been engaged in boring for water in Providence, R. I. has presented to the publick some remarkable results. In his second experiment in boring, he selected the extreme point of a wharf, many yards from the original land. He bored through a stream of mud—then through sand and quartz gravel. At this point water impregnated with copperas and arsenick, broke forth; but determining to proceed farther, Mr. Horton next struck a vineyard and drew up vines, grapes, grape seeds, leaves, acorns, hazel nuts, pine nuts, and the seeds of unknown fruits, together with pure water. This was 35 feet below the bed of the river.—(Balt. Chron.)

Intense Light.—It is stated by M. Pleischl, that hydrate of lime, pulverised and exposed upon charcoal to a stream of oxygen, through a blow-pipe with an orifice 1-50 inch in diameter, fed by a common lamp, gives the most intense light. He attributes this to a sort of pulverulent atmosphere, which the lime disengages at that temperature. Substances which do not emit molecules in a gaseous state cannot produce so vivid an incandescence.

To prepare an Oil for Clocks, and other delicate Machinery.

The oil for diminishing friction in delicate machines, ought to be completely deprived of every kind of acid and mucilage: and to be capable of enduring a very intense degree of cold without freezing. In fact, it ought to consist entirely of *elain* or the *oily* principle of solid fat and to be perfectly free from *stearine* or *solid fat.*

Now it is not a difficult matter to extract the *elain* from all the fixed oils, and even from seeds, by the process recommended by Chevreul, which consists in treating the oil in a mattras with seven or eight times its weight of alcohol till boiling. The liquid is then to be decanted, and exposed to the cold, the *stearine* will then separate from it in the form of a crystalized precipitate. The alcholick solution is afterwards to be evaporated to a fifth part of its volume, and the *elain* will then be obtained, which ought to be colourless, insipid, without smell, and incapable of altering the colour of the infusion of litmus or turnsole, and having the consistence of pure, white, olive oil.

Corn Cobs.—It has been pretty accurately ascertained that 13 bushels of Indian corn in the ear, ground up, corn and cobs together, afford *at least* as much nutriment in feeding cattle, as nine bushels of corn without the cobs. The difference is owing to the great quantity of sacharine matter contained in the cobs, as well as the additional stimulus of distension afforded by the food, which is all important for graminiverous animals.—(Columbian Spy.)

Process of Browning Gun-barrels.—Gun-barrels are browned by a process of oxidizement. There are several processes recommended.—One of which is to rub the barrel over with diluted nitrick or muriatick acid, and then, to lay it by for a week or two, until a complete coat of rust is formed. A brush, made of iron wire, is then applied; afterwards, oil and wax, and the barrel is finished by rubbing it with a cloth. Sometimes a mixed solution of sulphate of copper, tincture of the muriate of iron, and sweet spirit of nitre is used. This is applied by means of a cloth. The object is to form a rust, and to render it permanent on the barrel by hard friction along with wax. When sulphate of copper is employed, metallick copper is precipitated on the barrel. A coat of rust, put on in this manner, prevents effectually the oxidizement of the iron; and in point of utility, and the saving of labour in polishing and keeping muskets in order, the browning of barrels is certainly advantageous. At sea, where iron is more readily oxidized, this plan ought always to be adopted. With regard to the use of dragon's blood, it is entirely too temporary in its effect to be depended on. An intelligent gun-smith, who followed the practice of browning barrels in Europe, states that he has known the *browning* to remain very perfect for years, and that the best mode of insuring its durability is to use the *steel brush* which *carries in*, as he expressed it, the rust.

An improved process for gilding iron or steel.—This process, which is less known among artists than it deserves to be, may

prove useful to those who have occasion to gild iron or steel. The first part of the process consists in pouring over a solution of gold in nitro-muriatick acid (aqua regia) about twice as much ether, which must be done with caution, and in a large vessel. These liquids must then be shaken together; as soon as the mixture is at rest, the ether will be seen to separate itself from the nitro-muriatick acid, and to float on the surface. The nitro-muriatick acid becomes more transparent, and the other darker than they were before; the reason of which is, that the ether has taken the gold from the acid. The whole mixture is then to be poured into a glass funnel, the lower aperture of which is small; but this aperture must not be opened till the fluids have completely separated themselves from each other. It is then to be opened; by which means the liquid which has taken the lowest place by its greater gravity, viz. the nitro-muriatick acid, will run off; after which, the aperture is to be shut, and the funnel will then be found to contain nothing but ether mixed with the gold, which is to be put into well-closed bottles and preserved for use. In order to gild iron or steel, the metal must be first well polished with the finest emery, or rather with the finest crocus martis or colcothar of vitriol, and common brandy. The auriferous ether is then to be applied with a small brush; the ether soon evaporates, and the gold remains on the surface of the metal. The metal may then be put into the fire, and afterwards polished. By means of this auriferous ether, all kinds of figures may be delineated on iron, by employing a pen, or fine brush. It is in this manner, we believe, that the Sohlinger sabre-blades are gilded.

Instead of ether, the essential oils may be used, such as oil of turpentine, or oil of lavender, which will also take gold from its solution.

To make shell-gold.—Grind up gold-leaf with honey in a mortar; then wash away the honey with water, and mix the gold-powder with gum-water. This may be applied to any article with a camel's-hair pencil, in the same way as any other colour.

Cure for the Tooth-Ache.—At a recent meeting of the London Medical Society, Dr. Blake stated that the extraction or excision of teeth was unnecessary. He was enabled, he said to cure the most desperate cases of tooth-ache, (unless the disease was connected with rheumatism,) by the application of the following remedy to the diseased tooth: Alum, reduced to an impalpable powder, two drachms; nitrous spirit of ether, seven drachms; mix and apply them to the tooth.

Simple Remedy to Purify Water.—It is not so generally known as it ought to be, that pounded alum possesses the property of puryfying water. A large table spoonful of pulverised alum, sprinkled into a hogshead of water, (the water stirred round at the time,) will, after the lapse of a few hours, by precipitating to the bottom the impure particles, so purify it, that it will be found to possess nearly all the freshness and cleanness of the finest spring water. A pailful, containing four gallons, may be purified with a single tea spoonful.

Painting Houses.—A writer in the New England Farmer says, "I believe it is a general practise for people to do their painting sometime during the three summer months; but repeated experiments have been made within a few years, which prove that a house painted late in autumn or in winter, will hold the paint more than twice as long as one painted in warm weather. The reason is obvious; for when paints are applied in cold weather, the oil, with other ingredients, *forms a hard cement* on the surface of the clap boards, which cannot be easily erased; whereas a building painted (as usual) in the heat of summer, will soon need a new coat; for the heat causes the oil to penetrate into the wood, and leaves the other component parts dry, which will soon crumble off."

Cider.—At the time of laying in cider I would observe, that mustard seed, put into new cider, will keep it much better than any thing I have tried. I put half a pint of common mustard seed into a barrel of new cider last fall, and let it remain on the lees without drawing off, till it was used, and it kept perfectly sweet to the last—not the new sickly sweet, but more like mellow old wine: the cider tasted a little of the mustard, but some gentlemen who drank it, thought it was improved by it. As the last year was the first time I put in the seed, I cannot say that it will always have the same effect, but so simple a thing is worth trying—for my cider was decidedly the best I ever drank. S.

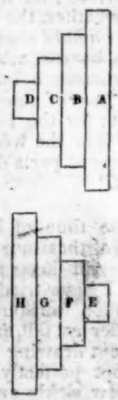
Defaced tortoise shell combs may be cleansed by rubbing them with pulverised rotten stone and oil; pulverised magnesia afterwards rubbed on with the dry hand, makes them brighter.

To take out cherry bounce or sweet meat juice when spilled on the clothes.—Dip in cold water the corner of a clean towel, and rub it on the stain before the article is washed. Continue it, changing to a clean part of the towel and dipping frequently in the cold water till the stain disappears, which will be in a few minutes. The sweeter the juice the sooner it will come out.

To remove Ink spots from Linen and Cotton.—Break off some cold tallow from a clean mould candle that has never been lighted. Rub it with your finger on the ink spots, and leave it sticking on in small lumps. This must be done before the linen is washed. It must be put into the tub with the tallow still on it. This will effectually remove the ink spots. The tallow must be rubbed on quite cold.

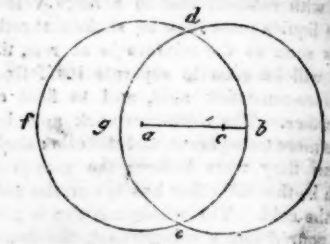
COMMUNICATIONS.] [FOR THE MAGAZINE.

MR. EDITOR—Since the question which I proposed in the last number of your Magazine, concerning the pullies, was published, it has occurred to me, that it might not be perfectly understood, as it stands at present. I will therefore explain it by a figure.



Suppose A, B, C, D. E, F, G, H. to represent two series of pullies, of four or a greater number in each. The diameters of A and its corresponding pulley E, are given, and the distance between their centres: and by a simple process, we may calculate the length of the band passing over them. The remaining pullies are to have certain velocities given them, that is, the diameter of B is to be to the diameter of F in a certain ratio, and the same with the diameters of the pullies C and G, D and H. Now it is required to find the diameters of these pullies, so that the band when shifted from A and E, on B and F, C and G, D and H, shall fit equally tight throughout the series.

A SUBSCRIBER.



Given a circle, the radius $a\ b$ of which $=1$; at what distance from the centre a, on the radius $a\ b$, must the centre c of a circle of the same radius, be taken, which, when described, shall divide the circle into two equal parts, that is, so that the area $d\ f\ e\ g$ shall be equal to the area $d\ b\ e\ g$?

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1 *Query.*—How can two sticks of timber be scarfed so that the new beam, thus formed, shall be equal in length to the sum of both beams?

2 *Query.*—Suppose one side of a right angled triangle =,999999999999999, and the other =,000000000000001, required the hypothenuse.

Method of fixing Colours.

An ox's gall will set any colour—silk, cotton or woollen. I have seen the colours of calico, which faded at one washing, fixed by it. Where one lives near a slaughter-house, it is worth while to buy cheap fading goods and set them in this way. The gall can be bought for a few cents. Get out all the liquid and cork it up in a large phial. One large spoonfull of this in a gallon of warm water is sufficient. This is likewise excellent for taking out spots from bombazine, bombazette, &c.

To make sea water fit for washing Linens at Sea.—Soda put into sea water renders it turbid, the lime and magnesia fall to the bottom. To make sea water fit for washing linen at sea, as much soda must be put in it as not only to effect a complete precipitation of these earths, but to render the sea water sufficiently lixivial or alkaline; soda should always be taken to sea for this purpose.